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NATIONAL DAM SAFETY PROGRAM. URSEL GINGERICH DAM (MO 10393), MI--ETC(U)
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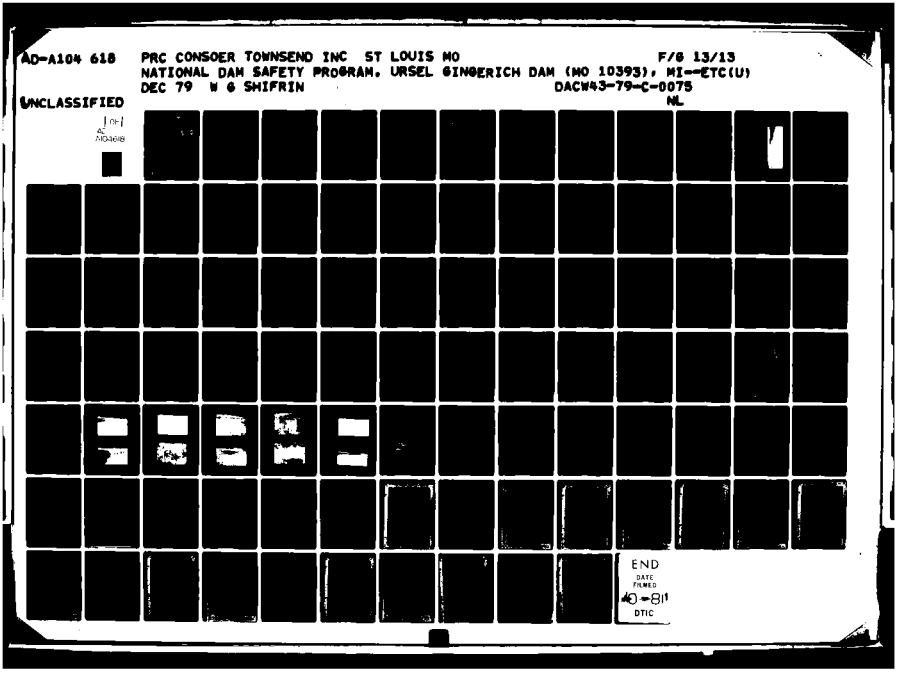

LEVEL II

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MISSISSIPPI·SALT·QUINCY RIVER BASIN

URSEL GINGERICH DAM
SCHUYLER COUNTY, MISSOURI.
~~MO. 10393~~

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

DECEMBER 1979

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7. AUTHOR(s) Consoer, Townsend and Associates, Ltd.	8. CONTRACT OR GRANT NUMBER(s) DACW43-79-C-0075
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 14 71
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.	

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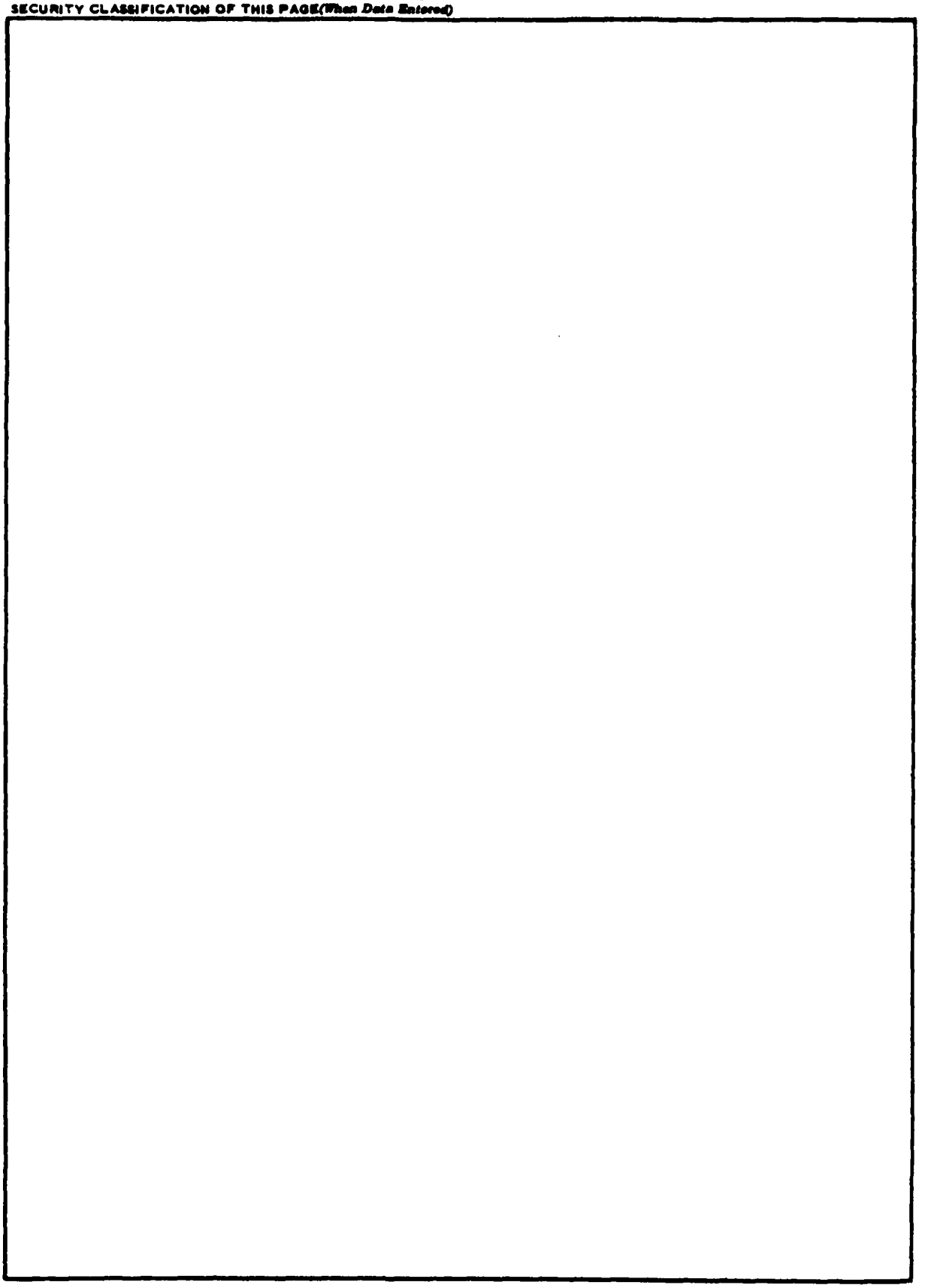

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Ursel Gingerich Dam (Mo. 10393) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Ursel Gingerich Dam (Mo. 10393).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: SIGNED
Chief, Engineering Division — 4 JAN 1980 — Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer — 4 JAN 1980 — Date

URSEL GINGERICH DAM
SCHUYLER COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10393

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
CONSOER, TOWNSEND AND ASSOCIATES, LTD.
ST. LOUIS, MISSOURI
AND
ENGINEERING CONSULTANTS, INC.
ENGLEWOOD, COLORADO
A JOINT VENTURE

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

DECEMBER 1979

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Ursel Gingerich Dam, Missouri Inv. No. 10393
State Located:	Missouri
County Located:	Schuyler
Stream:	An unnamed tributary of the North Fork of Middle Fabius River
Date of Inspection:	August 21, 1979

Assessment of General Condition

Ursel Gingerich Dam was inspected by the engineering firms of Consoer, Townsend and Associates, LTD., and Engineering Consultants, Inc. (A Joint Venture) of St. Louis, Missouri according to the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and State agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Within the estimated damage zone of four miles downstream of the dam are the intersection of U.S. Highways 63 and

139, one reservoir and dam, three dwellings and two county highway crossings which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Ursel Gingerich Dam is in the small size classification since it is less than 40 feet high and impounds less than 1,000 acre-feet of water.

Our inspection and evaluation indicates that the spillway of Ursel Gingerich Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Ursel Gingerich Dam being a small size dam, with a high hazard potential, is required by the guidelines to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping. Since there is high hazard potential downstream of the dam, the appropriate spillway design flood for this dam is the Probable Maximum Flood. It was determined that the reservoir/spillway system can accommodate 29 percent of the Probable Maximum Flood without overtopping the dam. Our evaluation indicates that the reservoir/spillway system will accommodate the 100-year flood without overtopping.

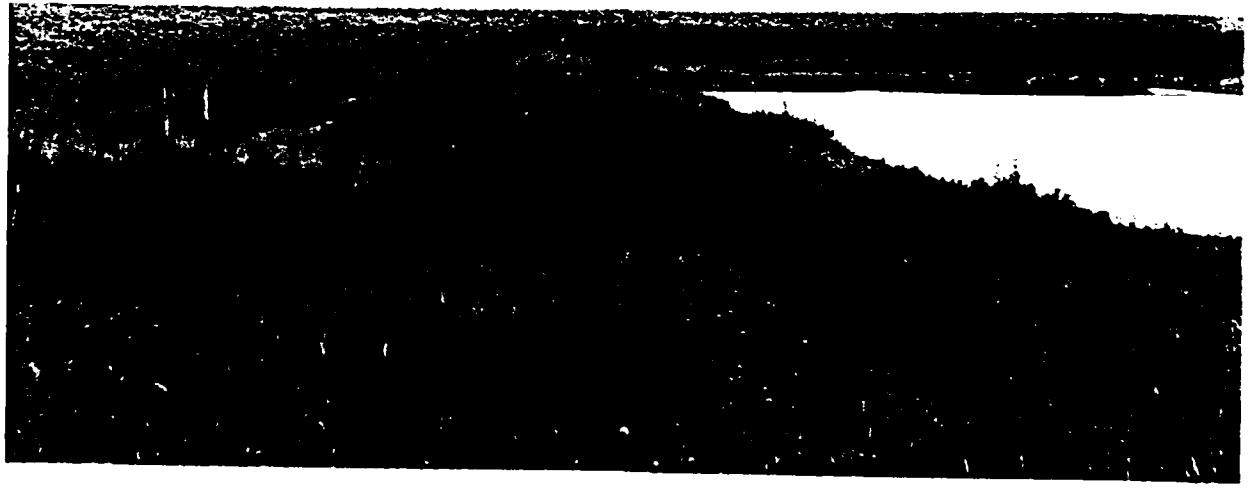
The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region. The 100-year flood is defined as a flood having a one percent chance of being equalled or exceeded during any given year.

Other deficiencies noted by the inspection team were: the erosion on the upstream slope due to wave action; minor sloughing of the upstream embankment slope around the intake to the service spillway pipe; the undermining of the downstream end of the spillway pipe due to a pond created by discharges through the service spillway; rodent activity on the embankment, a need for periodic inspection by a qualified engineer and a lack of mainten-

ance schedule. The lack of stability and seepage analyses on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.

Walter G. Shifrin, P.E.



Overview of Ursel Gingerich Dam

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

URSEL GINGERICH DAM, I.D. No. 10393

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

URSEL GINGERICH DAM, Missouri Inv. No. 10393

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Ursel Gingerich Dam was carried out under Contract DACW 43-79-C-0075 between the Department of the Army, St. Louis District, Corps of Engineers, and the engineering firms of Consoer, Townsend & Associates Ltd., and Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of Ursel Gingerich Dam was made on August 21, 1979. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an assessment of hydrologic and hydraulic conditions at the site; presents an assessment as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing, and detailed analyses were not within the scope of this study. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that reference in this report to left or right abutments is as viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to the north abutment or side, and right to the south abutment or side.

d. Evaluation Criteria

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in the publication "Recommended Guidelines for Safety Inspection of Dams", Appendix D. These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The following description is based on the limited design drawings, observations and field measurements made during the visual inspection.

The dam is a zoned earthfill structure between earth abutments. The crest is 12 feet wide and 440 feet long. The crest elevation is approximately 971.3 feet above MSL. The maximum height of the embankment was measured as 25 feet. The upstream and the downstream embankment slopes were measured as 1V to 3.5H. The upstream slope was measured from reservoir surface to crest. The drawings show both the upstream and the downstream embankment slopes as 1V to 3H.

According to the design drawings, a core trench was provided along the centerline of the dam. The trench has a bottom width of 10 feet and side slopes of 1V to 1H. The maximum depth of excavation was 4 feet.

There are two spillways for Ursel Gingerich Dam. The service spillway consists of a 12-inch diameter cast iron pipe which passes through the embankment. The spillway is located 200 feet to the left of the right abutment. A perforated metal cylinder is provided on the upstream end of the pipe as a trashrack.

The emergency spillway is a cut on the left abutment. The spillway is an open channel with side slopes of approximately 1V to 2.5H with a bottom width of 34 feet. According to the design drawings, the bottom width of the channel is 20 feet. The total length of the spillway channel is approximately 150 feet.

No regulated outlet works is provided for the dam.

b. Location

The Ursel Gingerich Dam is located on the headwaters of an unnamed tributary to the North Fork of the Middle Fabius River in Schuyler County, Missouri. The city of Lancaster is approximately two miles downstream of the dam. The dam and lake are located in Section 10, Township 66 North, Range 15 West as shown on an unpublished copy of the Moulton Southeast, Missouri and Iowa Quadrangle sheet (7.5 minute series).

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams", by the U.S. Department of the Army, Office of the Chief Engineer, the dam is classified in the dam size category as being "Small" since its storage is less than 1,000 acre-feet. The dam is also classified as "Small" in dam size category because its height is less than 40 feet. The overall size classification is, accordingly, "Small" in size.

d. Hazard Classification

The dam has been classified as having "High" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with the classification. The estimated damage zone extends approximately four miles downstream of the dam. Within the damage zone are the intersection of U.S. Highways 63 and 139, one reservoir and dam, three dwellings and two county highway crossings.

e. Ownership

The Ursel Gingerich Dam is privately owned by Mr. Ursel Gingerich. The mailing address is Ursel Gingerich, Rt. M, Glenwood, Missouri, 63541.

f. Purpose of Dam

The main purpose of the dam is to impound water for recreational use and livestock water supply.

g. Design and Construction History

Ursel Gingerich Dam was designed by the Soil Conservation Service, U.S. Dept. of Agriculture, Schuyler County Missouri, in March, 1964. The design engineer was Mr. John Rice.

According to the owner, Mr. Ursel Gingerich, the dam was constructed by Meyrl Ferguson, a contractor from Kirksville, Mo. shortly after the design phase was completed.

h. Normal Operational Procedures

There are no specific operational procedures for the dam. The lake is used for recreational purposes and the water level below the spillway crest is controlled by rainfall, runoff and evaporation.

1.3 Pertinent Data

a. Drainage Area (square miles):	0.20
b. Discharge at Damsite	
Estimated experienced maximum flood (cfs):	NA
Estimated ungated spillway capacity with reservoir at top of dam elevation (cfs):	227
c. Elevation (Feet above MSL)	
Top of dam:	970.3
Spillway crest:	
Service Spillway	967.0 (Assumed)
Emergency Spillway	968.8
Normal Pool:	967.0
Maximum Pool (PMF):	971.99
d. Reservoir	
Length of pool with water surface at top elevation of dam elevation (Feet):	1,400
e. Storage (Acre-Feet)	
Top of dam:	96
Spillway crest:	
Service Spillway	48.0
Emergency Spillway	70.0
Normal Pool:	48.0
Maximum Pool (PMF):	132
f. Reservoir Surface (Acres)	
Top of dam:	17
Spillway crest:	
Service Spillway	12.0
Emergency Spillway	14.7
Normal Pool:	12.0

Maximum Pool (PMF):	19.5

g. Dam*

Type:	Earthfill
Length:	440 feet
Structural Height:	25 feet (Measured)
Hydraulic Height:	25 feet
Top width:	12 feet
Side slopes:	
Downstream	1V to 3.5H (Measured)
Upstream	1V to 3.5H (From the crest to the water surface, measured) 1V to 3H (Below the water surface)
Zoning:	2 zones: 1. Upstream and downstream shells of the least impervious material. 2. Impervious Core.
Impervious core:	See zoning
Cutoff:	Core trench, 10 foot bottom width, maximum depth of 4 foot, 1V to 1H side slopes
Grout curtain:	Unknown

h. Diversion and Regulating Tunnel — None

i. Spillway

Type:	
Service Spillway	12-inch Cast Iron pipe, uncontrolled
Emergency Spillway	Open Channel, uncontrolled
Length of crest	
Service Spillway	12-inch diameter Cast Iron pipe
Emergency Spillway	34 feet
Crest Elevation (feet above MSL):	
Service Spillway	967.0 (Assumed)
Emergency Spillway	968.8

j. Regulating Outlets None

* Dimensions are according to the design drawings unless otherwise noted.

SECTION 2 : ENGINEERING DATA

2.1 Design

A three page set of design drawings has been made available from the Soil Conservation Service and is included as part of this Report.

2.2 Construction

No construction related data are available for the Ursel Gingerich Dam.

2.3 Operation

No operational data are available for the dam.

2.4 Evaluation

a. Availability

Only the three page set of drawings and several sheets of surveyors notes are available for this dam.

No pertinent data was available for review of hydrology, spillway capacity, flood routing through the reservoir, outlet capacity, slope stability or seepage analysis.

b. Adequacy

The lack of engineering data did not allow for a definitive review and evaluation. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection, past performance history, and sound engineering judgment.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

The design drawings included in the report are of a questionable validity since they are not as-built drawings.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Ursel Gingerich Dam was made on August 21, 1979. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Dr. M.A. Samad	Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
Mark R. Haynes	Engineering Consultants, Inc.	Civil, Structural and Mechanical
Dawn L. Jacoby	Engineering Consultants, Inc.	Soils
Peter L. Strauss	Engineering Consultants, Inc.	Geology
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil and Structural

Specific observations are discussed below.

b. Dam

The dam is in generally good condition. The crest of the dam is protected against surface erosion by an adequate cover of vegetation. One small depression was observed on the right abutment. The depression was approximately 1 foot deep and 75 feet wide. The depression did not appear to indicate an unstable condition in the embankment or abutment. No other depression or bulges were observed on the crest. Some shrinkage cracks were observed. No deviations in horizontal or vertical alignment were apparent.

The upstream slope is protected from wave erosion by riprap to about 1-1/2 feet above the water surface. Minor wave erosion was observed on the upstream slope. The upper section of the slope is protected by an adequate cover of vegetation. No other bulges or depressions were apparent. No cracks or signs of instability were observed. Material exposed in eroded areas was classified as a silty clay with low to medium plasticity.

The downstream slope is protected from surface erosion by a dense cover of vegetation. The slope is hummocky which appears to be due to livestock activity on the embankment. A barbed wire fence across the dam near the top of the downstream slope appears to have prevented livestock from doing further damage to the embankment. The embankment appears to bulge over the pipe used as the service spillway. No large depressions were observed. No cracks or signs of instability were apparent. Evidence of rodent activity was observed on the downstream slope. No seepage was observed on the embankment slope or downstream of the toe. There was no evidence of the dam ever being overtopped.

According to the "Missouri General Soil Map and Soil Association Description" published by the Soil Conservation Service, the materials in the general area of the dam belong to the soil series of Mexico-Leonard-Armstrong-Lindley in the Central Claypan Area forest. The soils are basically formed from loess and glacial till. The permeability of these soils range from slow to moderately slow. The Lindley silt may be susceptible to excessive erosion. If the Lindley silt was used in the embankment, the embankment may be susceptible to erosion and failure should overtopping result during a flood

The abutments for the dam slope gently upward from the crest. No evidence of erosion or instability were observed on the abutments.

c. Project Geology

The damsite is physiographically located in the Dissected Till Plains Section of the Central Lowlands Physiographic Province, according to Nevin Fenneman's "Physiography of the Eastern United States". This section is distinguished from the Till Plains on the east and from the Young Drift section on the north by the stage it has reached in the post-glacial erosion cycle. Broadly generalized, this section is a nearly flat till plain submature to mature in its erosion cycle.

No folds or faults have been identified in the vicinity of the dam.

The site bedrock geology, beneath the drift, as shown on the Geologic Map of Missouri, (1979), is interbedded Pennsylvanian age shales, limestones, sandstones. These strata generally strike north-south and dip gently to the west.

No bedrock was seen at or in the vicinity of the damsite. The entire area is mantled by glacial drift.

d. Appurtenant Structures

(1) Spillways

The service spillway is a 12-inch diameter cast iron pipe which passes through the embankment at approximately 10 degrees from horizontal. Headwalls were not provided for the spillway on neither the upstream nor downstream end. Consequently, some minor sloughing of the upstream slope above and around the spillway pipe has occurred due to wave action and discharges through the pipe. Discharges through the pipe have created sort of a stilling basin just downstream of the pipe and have undermined the pipe slightly on the downstream end. The trashrack was in good condition and unclogged. The pipe was discharging about 1/2 cfs at the time of the inspection. The exposed portion of the pipe exhibited no evidence of misalignment and instability. No seepage was observed around the pipe.

The emergency spillway was heavily covered with grass. The emergency spillway channel was not obstructed and had a barbed wire fence across the channel. The right side of the channel consisted of a berm perpendicular to the embankment, which helps channelize discharges through the spillway away from the downstream slope of the dam. Some erosion of the left side slopes of the channel was observed. No other indication of instability in the slopes were apparent.

(2) Outlet Works

There is no regulated outlet works or low level drain pipe at the dam.

e. Reservoir Area

The water surface elevation was approximately 967.0 feet above MSL on the day of the inspection.

The reservoir rim is gently sloped. Some minor erosion around the reservoir rim and especially in the right abutment area due to wave action was observed. No indication of instability on the slopes was apparent. The slopes above the reservoir are used for farming and pasture.

f. Downstream Channel

The downstream channel for both the emergency and service spillway is a wide open grassy pasture and is unobstructed. Discharges through both spillways will converge just downstream of the dam.

3.2 Evaluation

The visual inspection did not reveal any items which are sufficiently significant to indicate a need for immediate remedial action.

The following conditions were observed which could affect the safety of the facility and will require maintenance within a reasonable period of time.

1. Erosion of the upstream slope due to wave action, if allowed to continue, would affect the stability of the dam.

2. Sloughing of the upstream slope above and around the service spillway pipe is indicative of local slope failure, and if allowed to continue, would affect the structural stability of the dam and the spillway.

3. The undermining and erosion at the downstream end of the service spillway pipe is a hazard to the structural integrity of the spillway and the embankment.

4. Rodent activities observed on the downstream slope jeopardize the safety of the dam. The holes created by the rodents make potential avenues for piping.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Ursel Gingerich Dam was built to impound water for recreational and livestock supply purposes. No specific operational procedures are in effect for this dam.

4.2 Maintenance of Dam

The dam is maintained by the owner, Mr. Ursel Gingerich, who lives nearby. The downstream slope and the crest are covered with vegetation. The upstream slope is partially covered with a fairly adequate layer of riprap protection. However, some wave erosion was observed on the slope. There is a barbed wire fence at the edge of the crest and downstream slope which keeps livestock from grazing on the embankment.

4.3 Maintenance of Operating Facilities

There are no operating facilities at this damsite. There is a perforated sleeve pipe fitted over the intake of the 12" spillway pipe, which serves as an adequate trash rack. No outlet works is provided for this dam.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any existing warning system in effect for this dam.

4.5 Evaluation

The operation and maintenance for Ursel Gingerich Dam seems to be satisfactory. The upstream slope at the water level is beginning to show signs of deterioration due to wave action. The items listed in Section 7 should receive attention within a reasonable period of time.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The watershed area of the Ursel Gingerich Dam upstream from the dam axis consists of approximately 129 acres. The watershed area is mostly pasture land. Land gradients in the higher regions of the watershed average roughly 2 percent, and in the lower areas surrounding the reservoir average about 6 percent. The Ursel Gingerich Dam Reservoir is located on the headwaters of an unnamed tributary to the North Fork of the Middle Fabius River. The reservoir is about one mile upstream from Lancaster City Dam. At its longest arm the watershed is approximately 1/2 mile long. A drainage map showing the watershed is presented as Plate 1 in Appendix B.

Evaluation of the hydraulic and hydrologic features of Ursel Gingerich Dam was based on criteria set forth in the Corps of Engineers' "Recommended Guidelines for Safety Inspection of Dams", and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorological Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based on criteria given in the Corps of Engineers' EM 1110-2-1411 (Standard Project Storm). The Soil Conservation Service (SCS) method was used for

deriving the unit hydrograph, utilizing the Corps of Engineers' computer program HEC-1 (Dam Safety Version). The unit hydrograph parameters are presented in Appendix B. The SCS method was also used for determining the loss rate. The hydrologic soil group of the watershed was determined by use of published soil maps. The hydrologic soil group of the watershed and the SCS curve number are presented in Appendix B. The curve number, the unit hydrograph parameters, the PMP index rainfall and the percentages for various durations were directly input to the HEC-1 (Dam Safety Version) computer program to obtain the PMF hydrograph. The computed peak discharges of the PMF and one-half of the PMF are 2113 cfs and 1057 cfs, respectively.

Both the PMF and one-half of the PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method also utilizing the HEC-1 (Dam Safety Version) computer program. The reservoir was assumed at the spillway crest level at the start of the routing computation. The peak outflow discharges for the PMF and one-half of the PMF are 1680 and 475 cfs, respectively. Both the PMF and one-half of the PMF when routed through the reservoir resulted in overtopping of the dam.

The size of physical features utilized to develop the stage-outflow relation for the spillways and overtop of the dam were determined from field notes, and sketches, prepared during the field inspection. The reservoir stage-capacity data were based on an unpublished copy of Moulton Southeast, Missouri and Iowa, Quadrangle topographic map (7.5 minute series). The spillway and dam overtop rating curve and the reservoir capacity curve are presented in Plates 2 & 3 respectively in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam must aim at avoiding overtopping. Overtopping is especially dangerous for an earth dam because of its erosive characteristics. The safe hydrologic design of an embankment dam requires a spillway discharge capability, in combination with an embankment crest height that can handle a very large and exceedingly rare flood without dam overtopping.

The Corps of Engineers design dams to safely pass the Probable Maximum Flood that is estimated could be generated from the dam's watershed. This is the generally accepted criterion for major dams throughout the world, and is the standard for dam safety where overtopping would pose any threat to human life. Accordingly the hydrologic requirement for safety for this dam is the capability to pass the Probable Maximum Flood without overtopping.

b. Experience Data

It is believed that records of reservoir stage or spillway discharge are not maintained for this site.

c. Visual Observations

Observations made of the spillway during the visual inspection are discussed in Section 3.1.c(1) and evaluated in Section 3.2.

d. Overtopping Potential

As indicated in Section 5.1.a, both the Probable Maximum Flood and one-half of the Probable Maximum Flood, when routed through the reservoir, resulted in overtopping of the dam. The peak outflow discharges for the PMF and one-half of

the PMF are 1680 cfs and 475 cfs, respectively. The maximum discharge capability of the spillways before overtopping the dam is 227 cfs. The PMF overtopped the dam crest by 1.69 feet and one-half of the PMF overtopped the dam crest by 0.77 feet. The total duration of embankment overflow is 5.33 hours during the PMF, and 2.17 hours during one-half of the PMF. The spillway/reservoir system of Ursel Gingerich Dam is capable of accommodating a flood equal to approximately 29 percent of the PMF before overtopping the dam. The spillway/reservoir system of Ursel Gingerich Dam will accommodate the 100-year flood without overtopping.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. The estimated damage zone extends approximately four miles downstream of the dam. Within the damage zone are the intersection of U.S. Highway 63 and 139, one reservoir and dam, three dwellings and two county highway crossings.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no major signs of settlement or distress observed on the embankment during the visual inspection. The dam crest and the downstream slope are well protected against surface erosion by vegetation. The upstream slope is provided with riprap protection. The minor erosion due to wave action on the upstream slope did not appear to effect the structural stability of the embankment in its present condition. Nevertheless, the erosion should be monitored and if the erosion continues, steps should be taken to control the problem. In the absence of seepage and stability analyses, no quantitive evaluation of the structural stability can be made.

The service spillway did not exhibit any evidence of structural instability. The minor sloughing on the upstream slope near the intake was not serious enough to constitute an unsafe condition. The undermining of the downstream end of the spillway pipe by the pond created due to discharges through the pipe and the pond itself do not pose a danger to the stability of the pipe or dam embankment in their present conditions. Nevertheless, the conditions described in Section 3.1.d(1) should be monitored and necessary repairs made.

The emergency spillway did not exhibit any evidence of structural instability. The erosion on the left slope of the emergency spillway does not constitute an unsafe condition because if the erosion is allowed to continue it will just

erode into the natural ground of the left abutment. This condition will not decrease the discharge capacity of the emergency spillway.

b. Design and Construction Data

No design computations were uncovered during the report preparation phase. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment. Likewise, no construction data or specifications relating to the degree of embankment compaction are available for use in a stability analysis.

c. Operating Records

No operating records are available relating to the stability of the dam or appurtenant structures. The water level on the day of the inspection was slightly above the invert of the service spillway, and it is assumed that the reservoir remains close to full at all times. No low level drain or regulated outlet works were provided for the dam.

d. Post Construction Changes

No post construction changes exist which will affect the structural stability of the dam.

e. Seismic Stability

The dam is located in Seismic Zone 1, as defined in "Recommended Guidelines For Safety Inspection of Dams" as prepared by the Corps of Engineers. A well designed and constructed earthen dam should not suffer significant damage as a result of an earthquake of Zone 1 intensity.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation, however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be assurance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Ursel Gingerich Dam was found to be "Seriously Inadequate". The spillway/reservoir system will accommodate only 29 percent of the PMF without overtopping the dam. The dam is overtopped by over 1-1/2 feet during the PMF and the duration of embankment overflow is over 5 hours. If the material in the dam is silty soil, the dam would be susceptible to erosion and failure during overtopping.

No quantitative evaluation of the safety of the embankment can be made in view of the absence of seepage and stability analyses. The present embankment and appurtenant structures, however, appeared to have performed satisfactorily since its construction without failure or evidence of instability. There was no evidence of the dam ever being overtopped.

The burrowing animals observed on the embankment could jeopardize the safety of the dam. The holes created by the animals make avenues for possible piping. The extent of the damage to the embankment done by the burrowing animals should be determined and corrective measures undertaken as required.

b. Adequacy of Information

The conclusions presented in this report are based on field measurement, limited design drawings, past performance and present condition of the dam. Information on the operation and maintenance of the dam were not available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished in the near future. The items recommended in Paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Phase II Inspection

Based on results of the Phase I inspection, and if the remedial measures recommended in Paragraph 7.2 are undertaken, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives:

Spillway capacity and/or height of dam should be increased to accommodate the PMF without overtopping the dam.

b. O & M Procedures:

1. Monitor the erosion on the upstream slope due to wave action and make repairs as required.

2. Monitor the minor sloughing of upstream slope around the intake to the service spillway and make repairs as required.

3. Monitor the pond created by discharges through the service spillway pipe and the undermining of the downstream end of the service spillway pipe, and make repairs as required.

4. Determine the extent of damage done to the embankment by burrowing animals, if any, and make corrective repairs as required.

5. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.

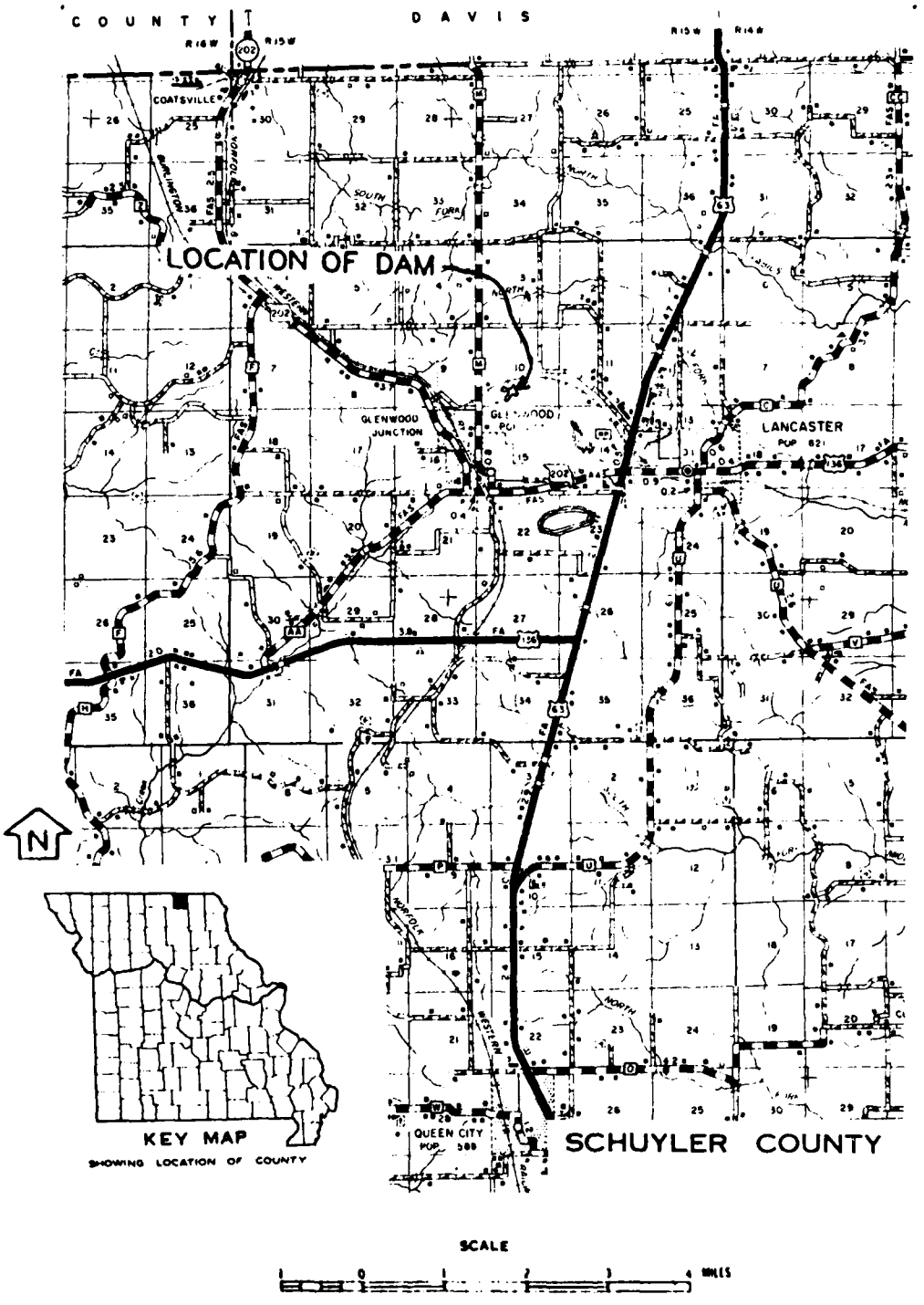
6. The owner should initiate the following programs:

   (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earthen dams.

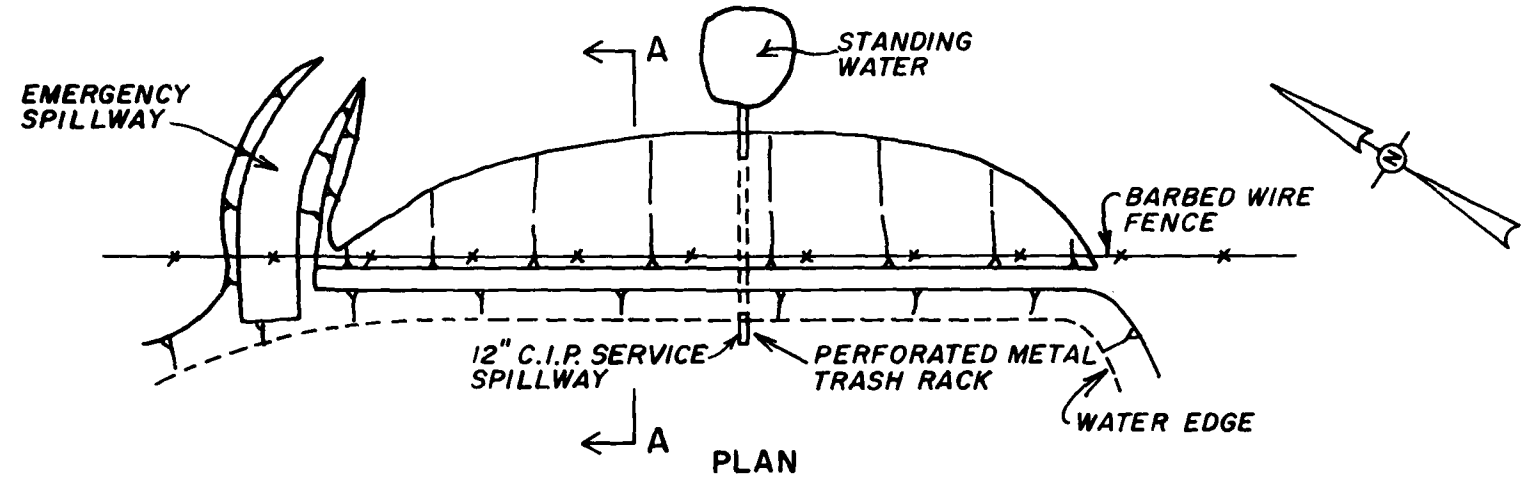
   (b) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

PLATES

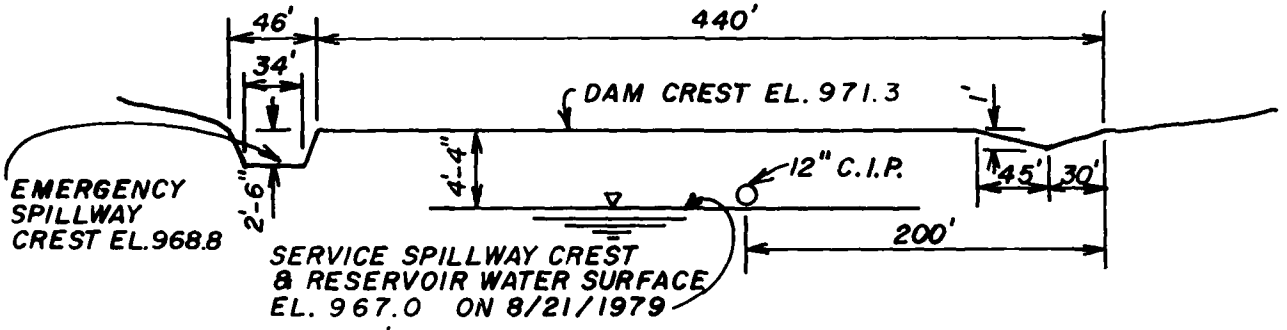
PLATE- 1



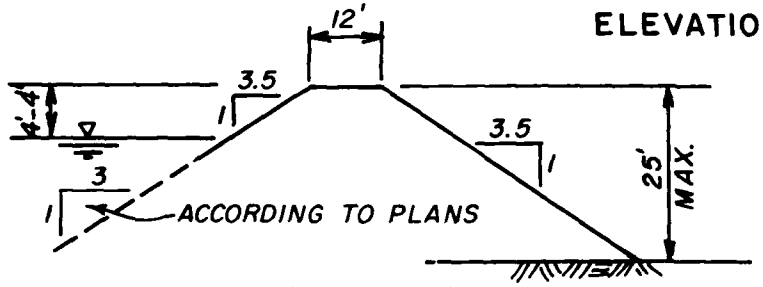
LOCATION MAP – URSEL GINGERICH DAM



PLAN



ELEVATION



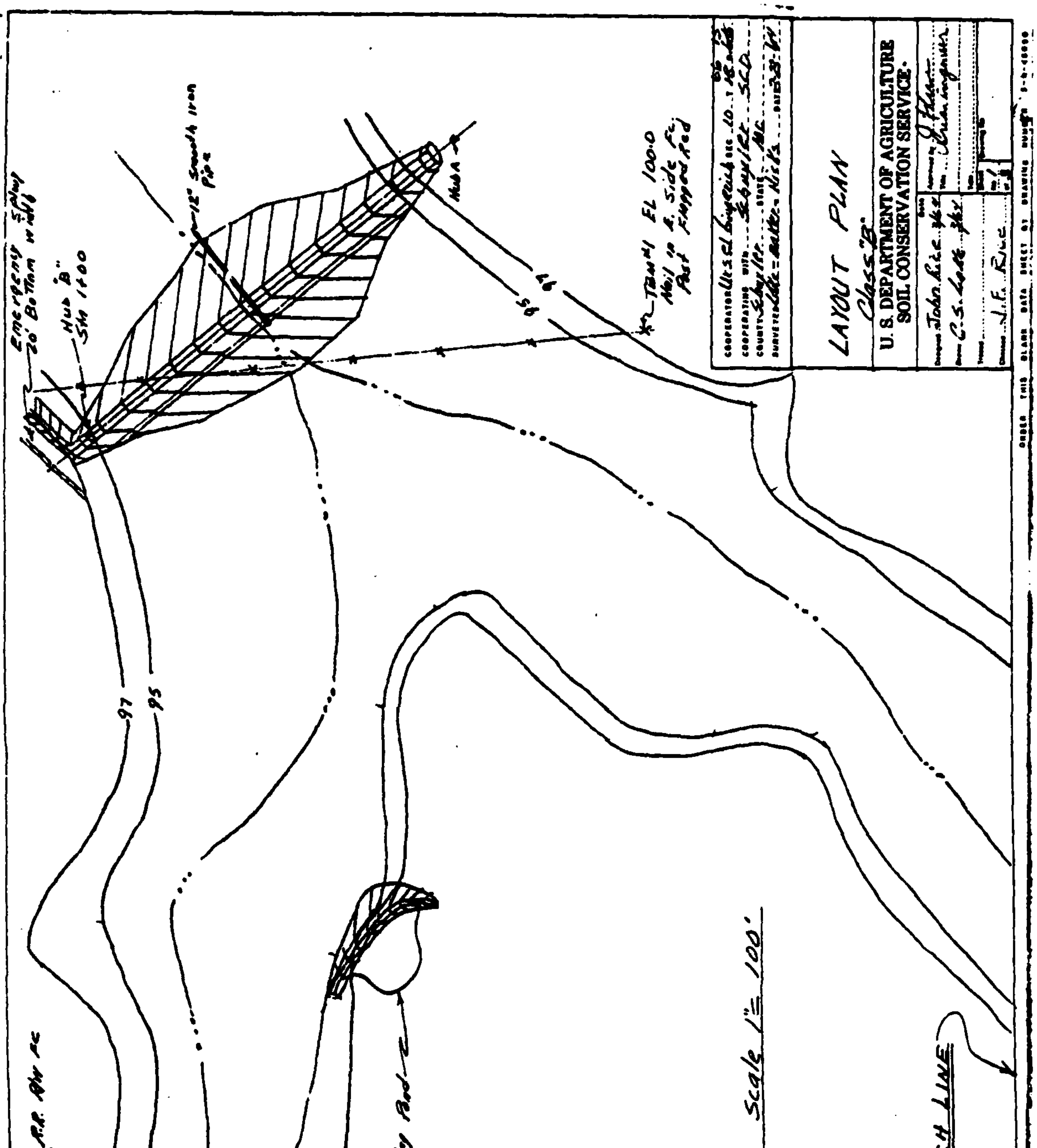
SECTION A-A
NOT TO SCALE

SCALE
1" = 100' (HORIZONTAL)
VERTICAL (NOT TO SCALE)

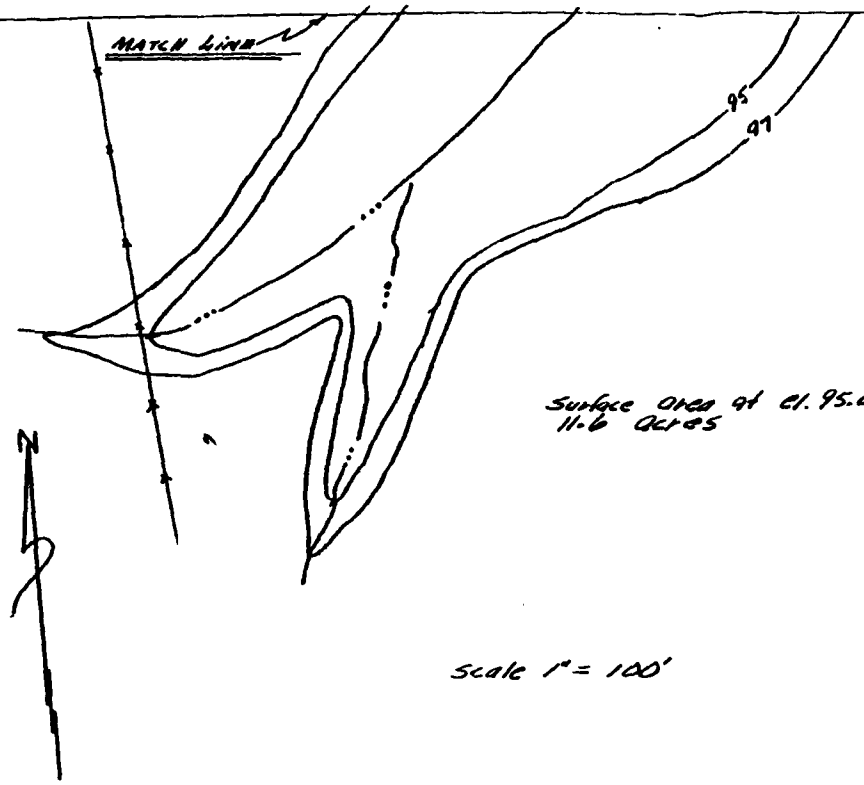
URSEL GINGERICH DAM (MO. 10393)
PLAN, ELEVATION & SECTION

PLATE 2

PLATE 3



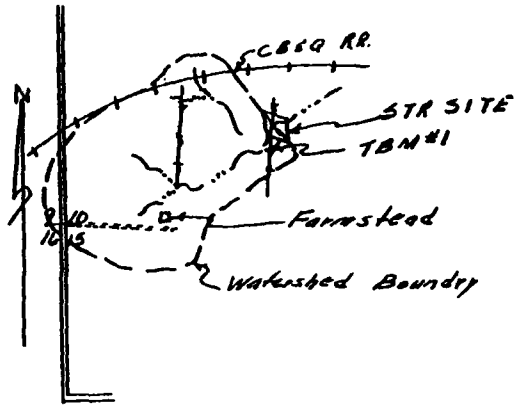
LAYOUT PLAN
Class "B"
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Emergency Spillway 20' Bottom width
Hub "B" Sta 1+00
12" Smooth iron Pipe
Hub A
97
95
Existing Pond
Scale 1" = 100'
MATCH LINE



Surface area at el. 95.0
11.6 acres

Scale 1" = 100'

WATERSHED MAP



Scale 1" = 1320'

COOPERATOR U. Gingerich ... SEC 10 T 15 R 6E
COOPERATING WITH ... Schuyler ... SCD
COUNTY Schuyler ... STATE ... NEB
SURVEYED Lister-Bodin-Nicks ... DATE 3-22-68

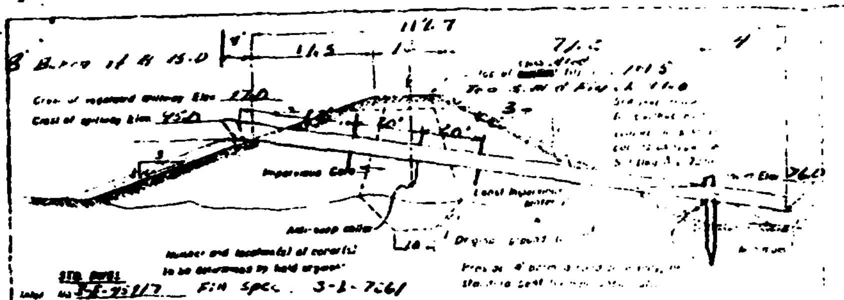
LAYOUT PLAN

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed John Rice	Date 3/69	Approved by J. A. Gustafson	
Drawn C.S. Locke	3/69	Title Area Conservationist	
Traced		Date	
Checked N.L. Rice 4-69		Sheet No.	Drawing No.

PLATE 4

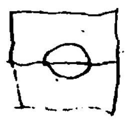
PLATE- 5



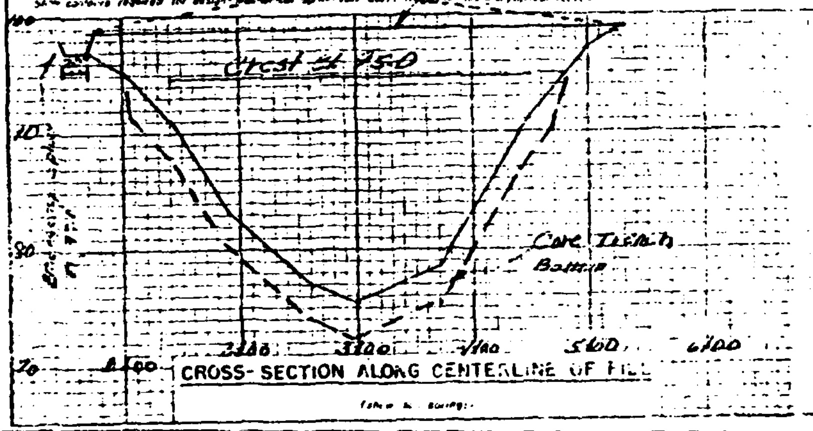
SECTION SHOWING MECHANICAL SPILLWAY

LAYOUT PLAN

For CMP Dimensions
Use Same for Smooth Iron



Top Unsettled Fill el. 101.5
Top Settled Fill el. 99.0



CROSS-SECTION ALONG CENTERLINE OF FILL

WATERSHED MAP

SCALE 1 INCH = FT.

DESIGN DATA

DRAINAGE AREA 90 ACS

SURFACE AREA PERM. POOL 11.6 ACS

VOL. FLOOD RUNOFF (V) = 21 AC. FT.

PIPE FLOW

H (TO EMER. SPILLWAY) = 20.5 FT

MAXIMUM STAGE 2 FT

VOL. FLOOD STORAGE REQ'D.

HOOD INLET

STAGE INLET INVERT TO EMERG. SPILLWAY ___ FT

EMERGENCY SPILLWAY

DESIGN Q = 50 CFS

WIDTH = 20 FT DEPTH OF FLOW (H) = 1.0 FT

FREEBOARD REQUIRED = 2.0 FT

ESTIMATED QUANTITIES

QUAN	UNIT	ITEM
115	FT	Pipe [illegible]
3		[illegible]
1		[illegible]
1		[illegible]
17.3	CY	EARTHFILL
5.6		[illegible]

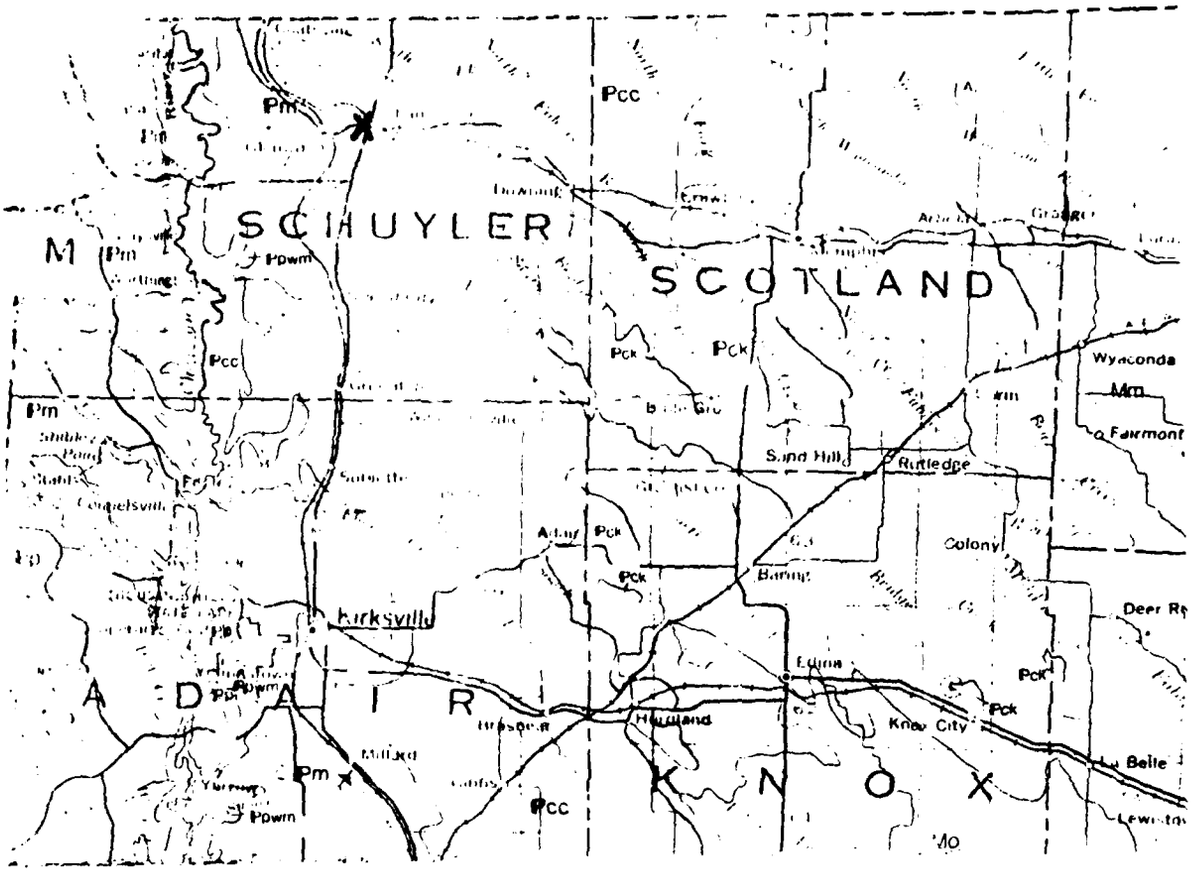
NOTE - Rivets in longitudinal seams of C.M. Pipe [illegible]

COOPERATOR U.S.C.I. [illegible]
COOPERATING WITH [illegible] COUNTY SCD
STATE MO. SEC 20 T R
SURVEYED [illegible] DATES [illegible]

HOOD INLET PIPE SPILLWAY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PLATE 6



PENNSYLVANIAN

- IPKc - KANSAS CITY GROUP
- IPp - PLEASANTON GROUP
- IPm - MARMATON GROUP
- IPcc - CHEROKEE GROUP, CABANISS SUBGROUP

X - LOCATION OF DAM, MO. 10393

REFERENCE:
GEOLOGIC MAP OF MISSOURI
MISSOURI GEOLOGIC SURVEY
1979

GEOLOGIC MAP OF SCHUYLER COUNTY AND ADJACENT AREA

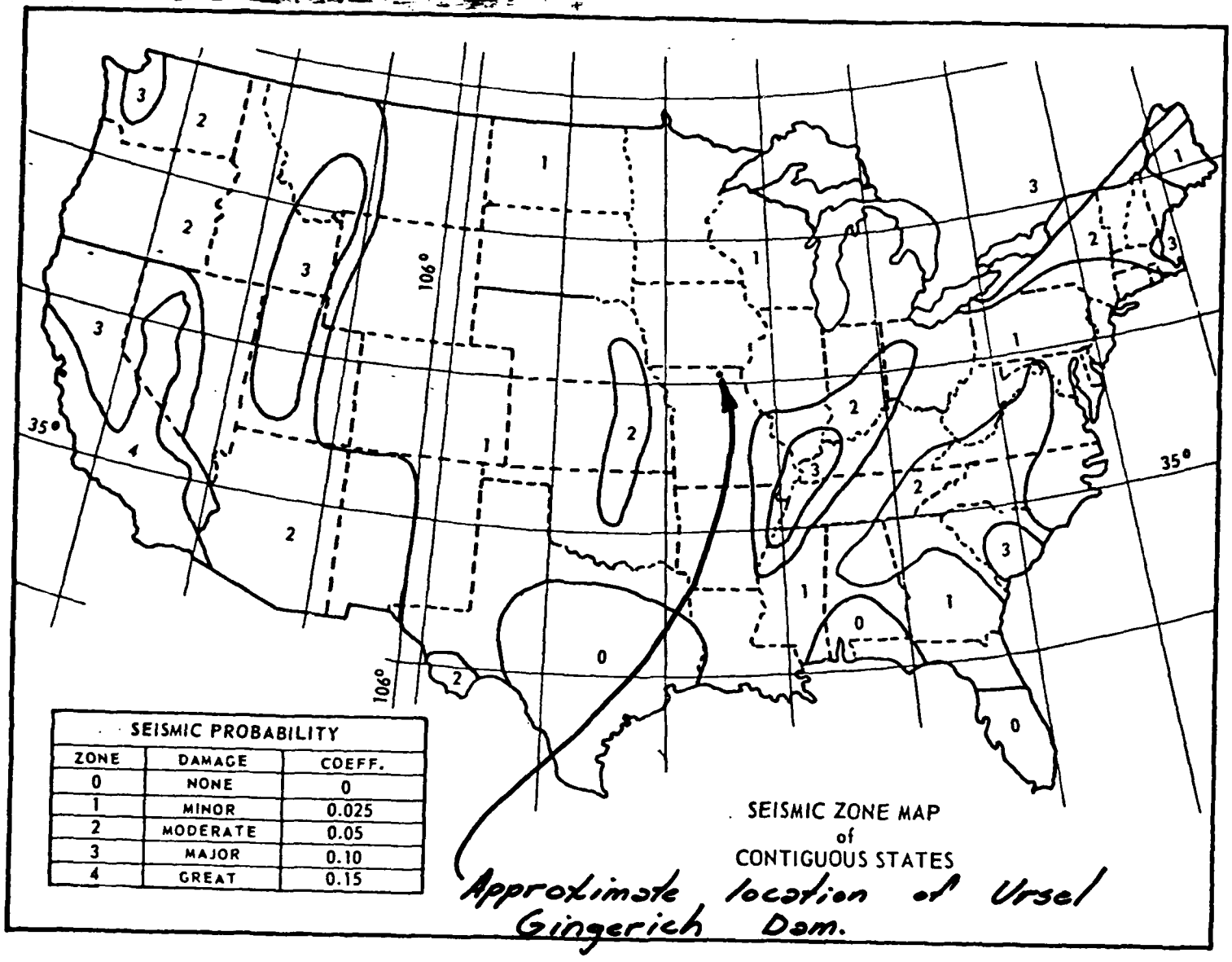
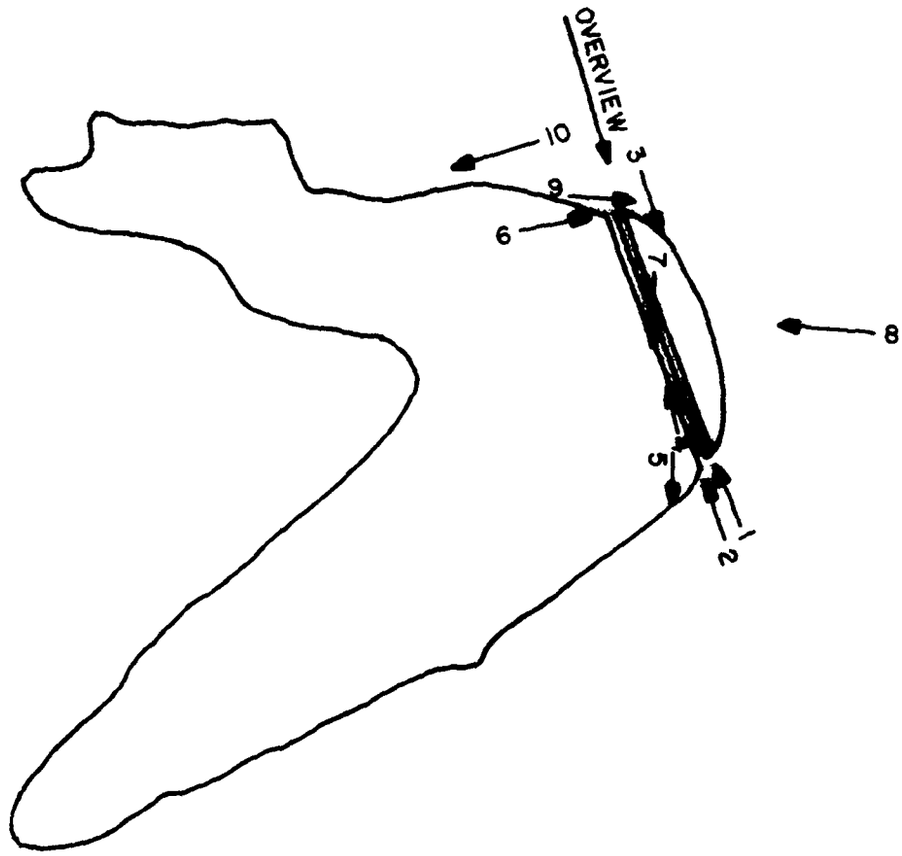

106°
35°
106°
35°
SEISMIC PROBABILITY
ZONE | DAMAGE | COEFF.
0 | NONE | 0
1 | MINOR | 0.025
2 | MODERATE | 0.05
3 | MAJOR | 0.10
4 | GREAT | 0.15
SEISMIC ZONE MAP
of
CONTIGUOUS STATES
Approximate location of Ursel
Gingerich Dam.

PLATE-7

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION



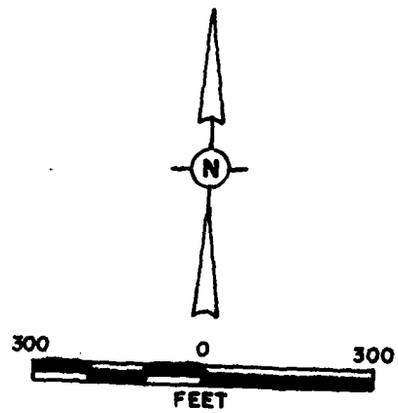


PHOTO INDEX
FOR
URSEL GINGERICH DAM

Ursel Gingerich Dam

Photo 1.	-	View of the crest.
Photo 2.	-	View of the upstream slope of the embankment.
Photo 3.	-	View of the downstream slope of the embankment.
Photo 4.	-	View of scarp on the upstream slope above the riprap.
Photo 5.	-	View of scarp on the right abutment due to wave action.
Photo 6.	-	View of the emergency spillway looking downstream.
Photo 7.	-	View of the service spillway and trashrack.
Photo 8.	-	View of the outlet of the service spillway.
Photo 9.	-	View looking downstream of the dam.
Photo 10.	-	View of the reservoir rim.

APPENDIX B

HYDROLOGIC COMPUTATIONS

Photo 1

Photo 2

Photo 3

Photo 4

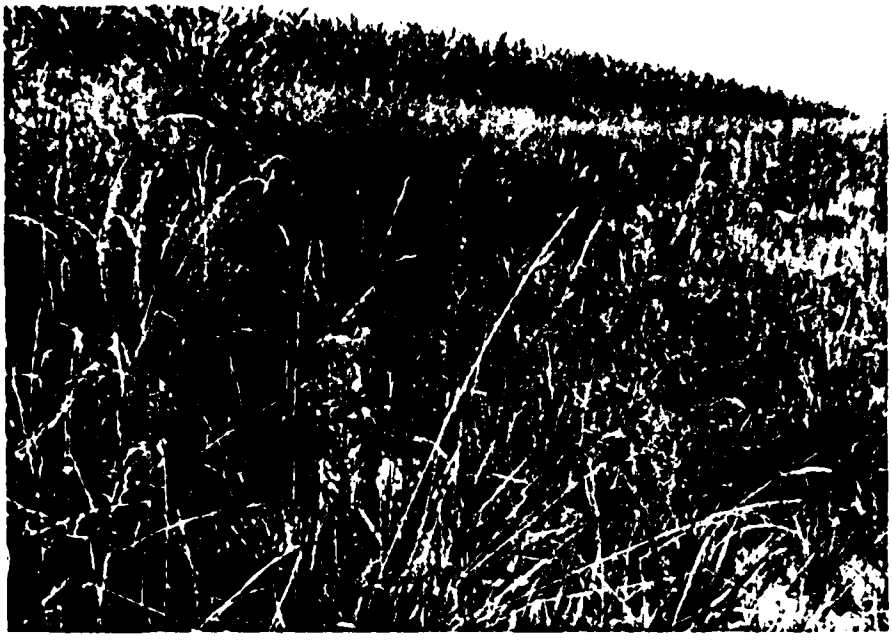


Photo 5

Photo 6

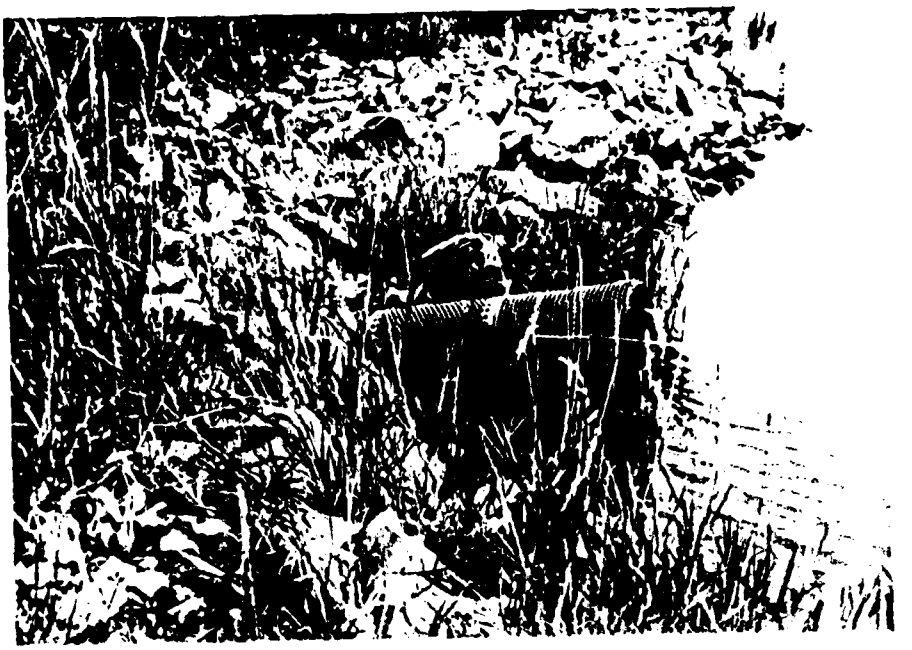


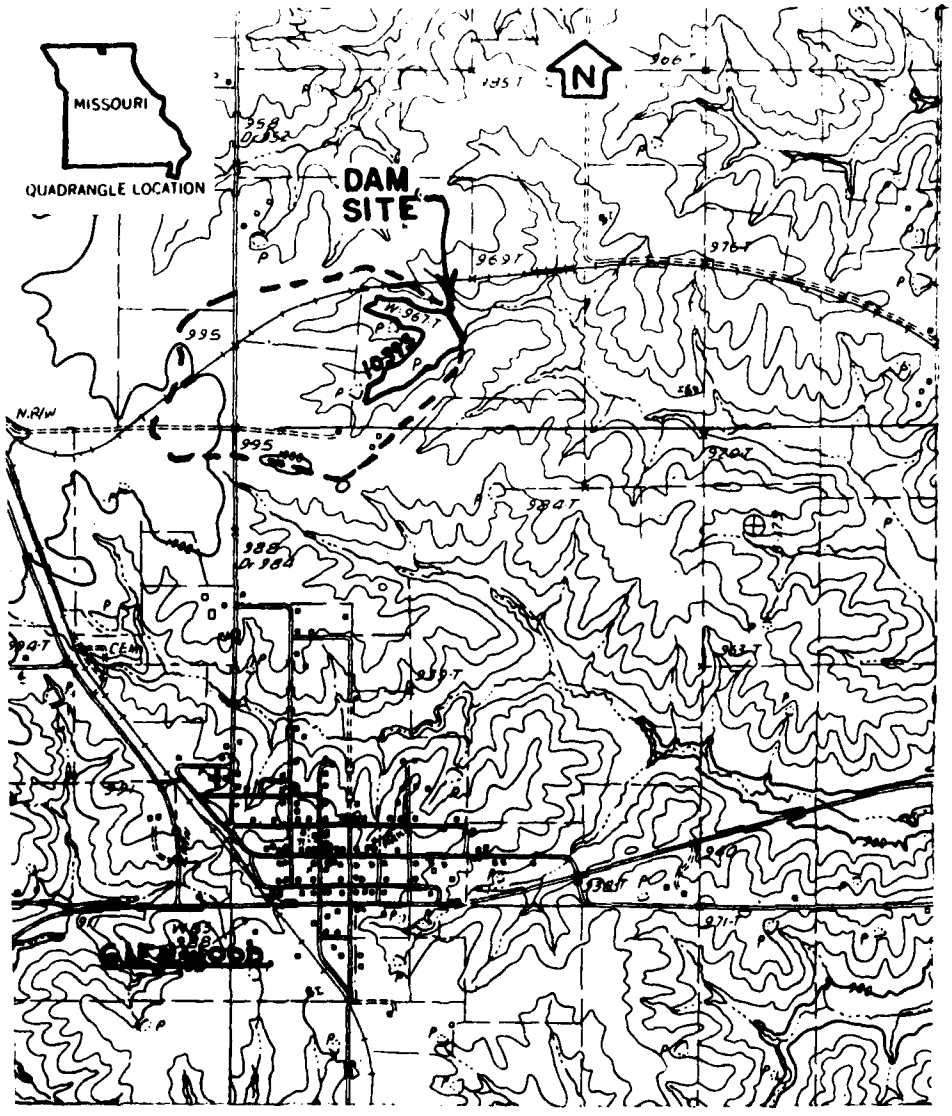
Photo 7

Photo 8

Photo 9

Photo 10

PLATE 1, APPENDIX B



SCALE 1 24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

DRAINAGE BOUNDARY — — — —

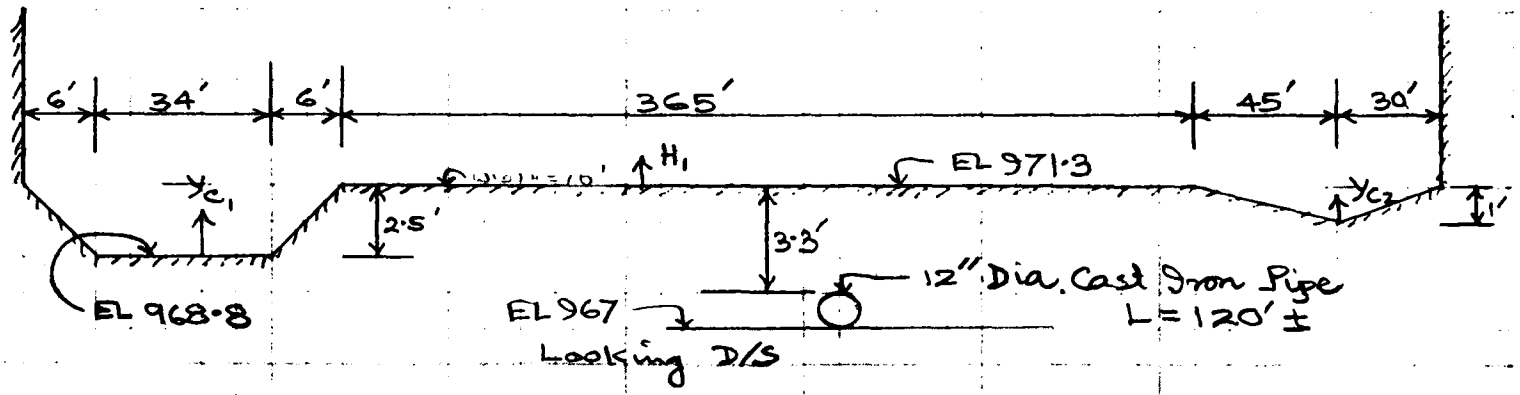
URSEL GINGERICH DAM (MO. 10393)
DRAINAGE BASIN

FIIC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI SHEET NO. 1 OF 3

URSEL GINGERICH DAM (MO. 10398) JOB NO. 1240-001

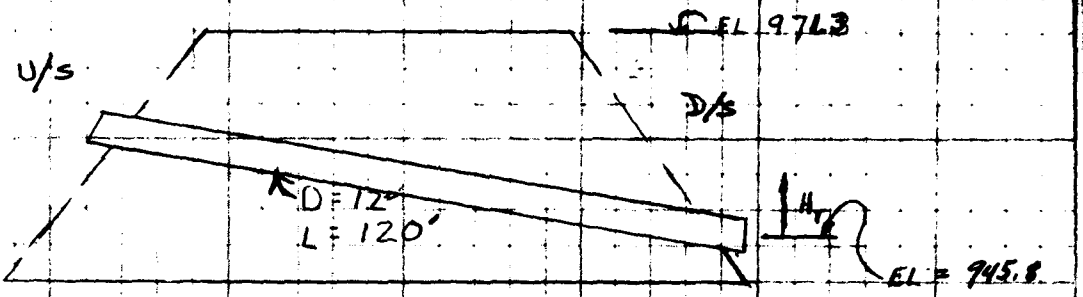
SPILLWAY & OVERTOP RATING CURVE BY RHK DATE 8-31-



B-3

y_{c_1}	T_{c_1}	A_{c_1}	$V_{c_1}=5.67\sqrt{\frac{A_{c_1}}{T_{c_1}}}$	$Q_{c_1}=V_{c_1}A_{c_1}$	U/S W.S. $=y_{c_1}+\frac{V_{c_1}^2}{2g}+968.8$	$y_{c_2}=\frac{2}{3}\times$ (U/S W.S. -970.3)	T_{c_2}	A_{c_2}	V_{c_2}	Q_{c_2}	H_1	L_1	C_1	$Q=C_1L_1H_1^{3/2}$	$Q=Q_1+Q_2+Q_3$
0	-	-	-	0	968.8	-	-	-	-	-	-	-	-	-	0
1	38.8	36.4	5.49	200	970.27	-	-	-	-	-	-	-	-	-	200
1.75	42.4	66.9	7.13	476	971.34	0.69	51.75	17.86	3.33	59.5	.64	365	2.49	7.3	543
2	43.6	77.6	7.56	587	971.69	0.93	69.75	32.4	5.17	180	.39	365	2.56	229	994
3	46.0	123	9.27	1140	973.13	1.89	75	104.3	6.68	697	1.83	365	2.64	2385	4222
5	46.0	205	12.26	2635	976.13	3.89	75	254.3	10.44	2655	4.83	365	2.64	10229	15519
7	46.0	307	14.65	4498	979.13	5.89	75	404.3	13.16	5322	7.83	365	2.64	21112	30931

FLOW THROUGH THE CAST IRON PIPE UNDER FRONT OF DAM



ϵ = .00085 FOR CAST IRON PIPE

ϵ/D = .00085

f = .019 - FROM MOODY DIAGRAM

$H = \left(1 + K_e + f\frac{L}{D}\right)\frac{V^2}{2g}$; Assume $K_e = 0.09$

$H = \left(1 + 0.09 + .019\frac{120}{1}\right)\frac{V^2}{2g}$

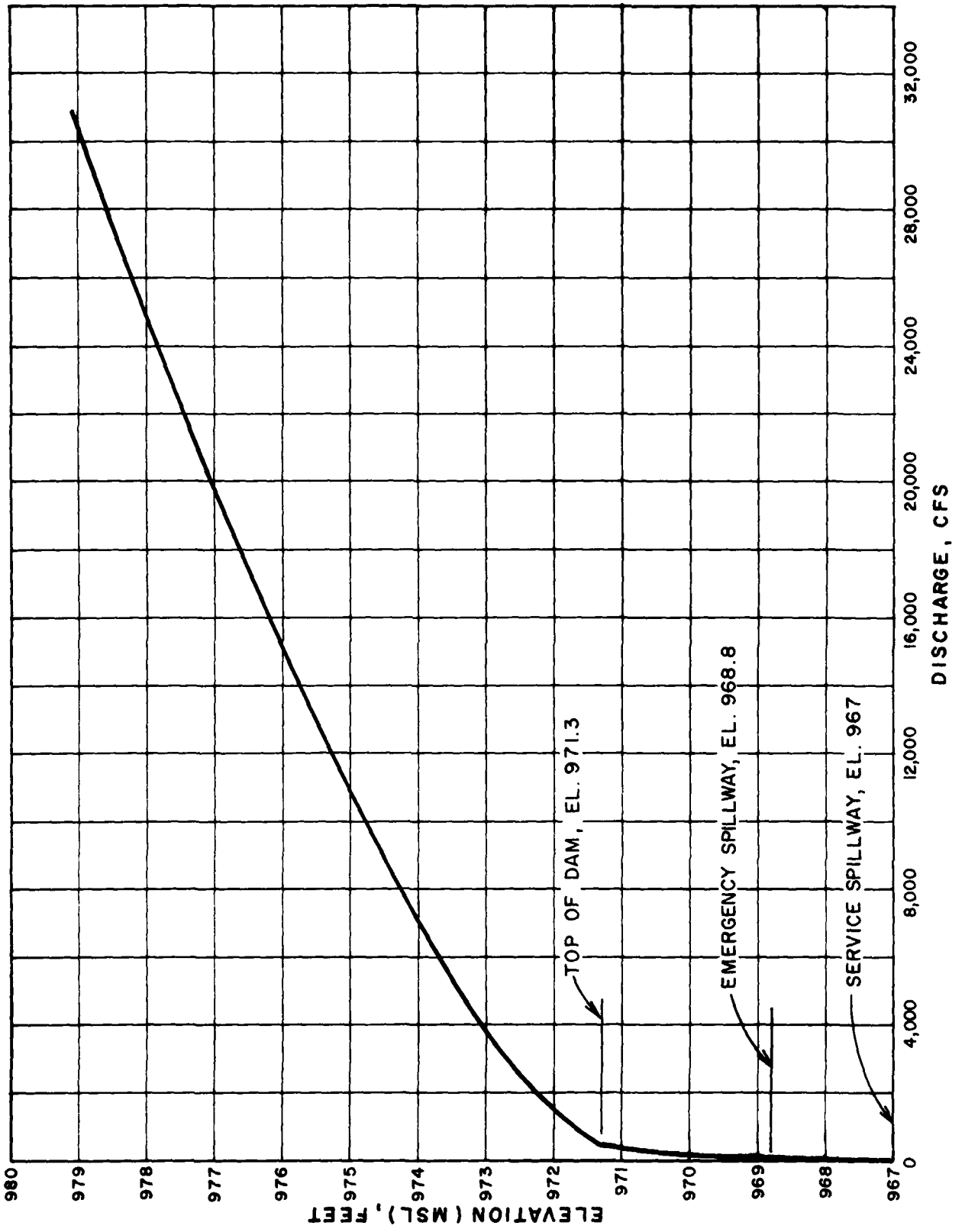
$H = 3.37\frac{V^2}{2g}$

$19.1H = V^2 = \frac{Q^2}{A^2}$

$11.79H = Q^2$

$3.43\sqrt{H} = Q$

RESERVOIR SURFACE ELEVATION	SPILLWAY DISCHARGE $Q = 3.43\sqrt{H_T}$	EMERGENCY SPILLWAY DISCHARGE	OVERTOP DISCHARGE	TOTAL DISCHARGE
967	—			0
968.8	16.5	0	0	17
970.27	17.0	200	—	217
971.34	17.3	476	66.8	540
971.69	17.5	587	407	1002
973.13	17.9	1140	3082	4220
976.13	18.9	2635	12884	15538
979.13	19.8	4497	26434	30931



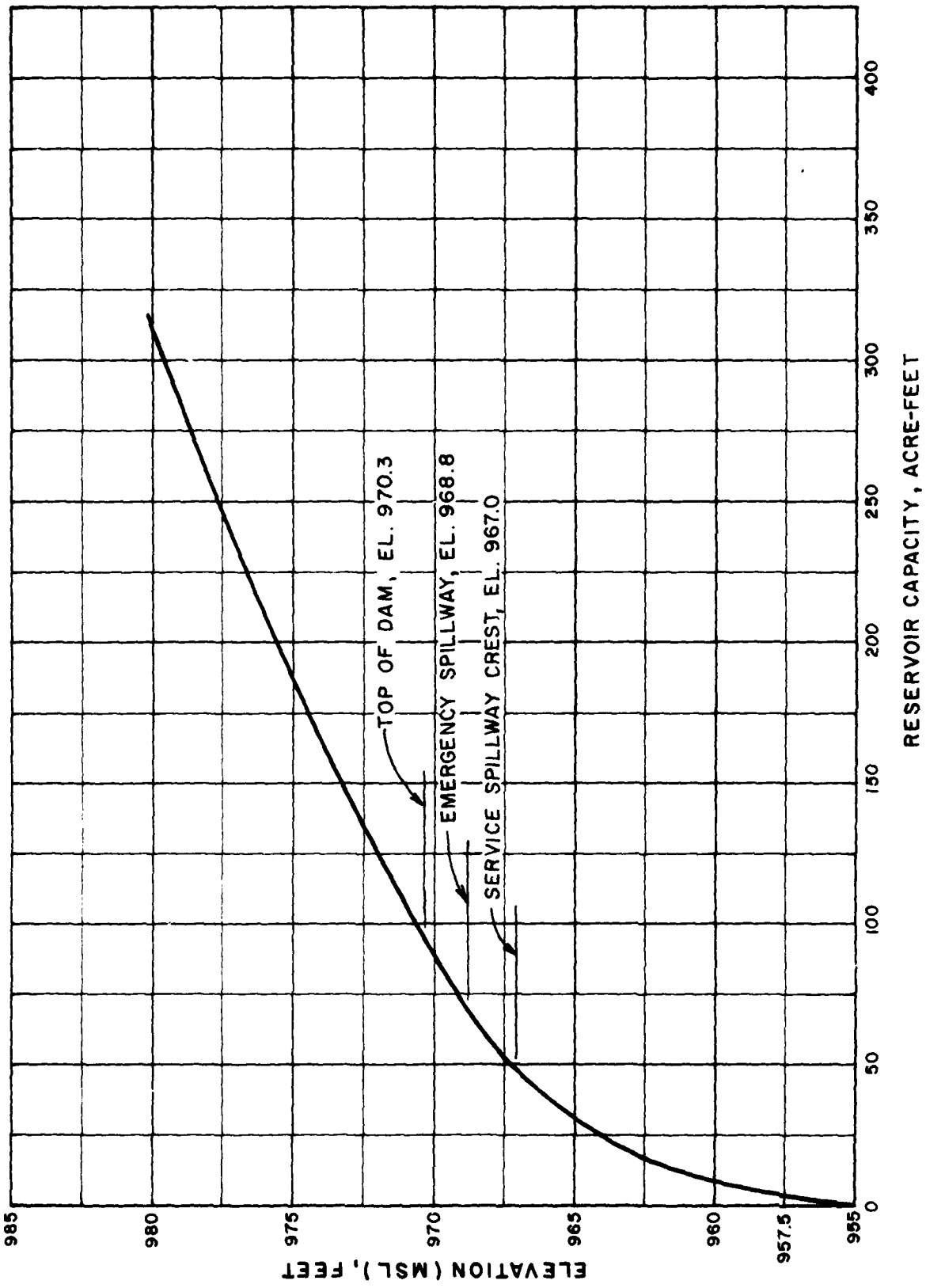
URSEL GINGERICH DAM (MO. 10393)
SPILLWAY & OVERTOP RATING CURVE

URSEL GINGERICH DAM

RESERVOIR AREA CAPACITY

ELEV. MSL Ft	RESERVOIR SURFACE AREA (ACRES)	INCREMENTAL VOLUME (AC-Ft)	TOTAL VOLUME (AC-Ft)	REMARKS
955	0	0	0	ESTIMATED STREAM BED AT CENTER OF DAM
967	12.0	48	48	ASSUMED SPILLWAY CREST
970.3	17.0	48	96	TOP OF DAM
980	32.8	237	333	

PLATE 3 APPENDIX B



URSEL GINGERICH DAM (MO. 10393)
RESERVOIR CAPACITY CURVE

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 1 OF ____

IRSEL GINGERICH DAM (10393) — JOB NO. 1240-001-1

UNIT HYDROGRAPH PARAMETERS — BY KLB DATE 8-17

1) DRAINAGE AREA = 129 AC = 0.20 SQ. MI.

2) LENGTH OF STREAM = L = (1.4" x 2000) = 2800 FT = 0.53 MI.

3) ELEVATION OF DRAINAGE DIVIDE ALONG THE LONGEST STREAM = H_1 = 1005

4) RESERVOIR ELEVATION AT SPILLWAY CREST = H_2 = 967

5) DIFFERENCE IN ELEVATION = $\Delta H = H_1 - H_2$ = 38 FT.

6) AVERAGE SLOPE OF STREAM = $\frac{\Delta H}{L} = \frac{38}{1005} =$ 3.78 %

7) TIME OF CONCENTRATION:

a) By KIRPICH FORMULA:

$$T_c = \left(\frac{11.9 \times L^3}{\Delta H}\right)^{0.385} = \left(\frac{11.9 \times 0.53^3}{38}\right)^{0.385}$$

T_c = 0.31 HR

b) By VELOCITY ESTIMATE

AVERAGE SLOPE = 3.78% ⇒ V = 3 FPS

$T_c = \frac{L}{V} = \frac{2800}{3 \times 3600} =$ 0.26 HR

USE T_c = 0.31 HR

8) LAG TIME = $L_t = 0.6 \times T_c = 0.6 \times 0.31 =$ 0.19 HR

9) UNIT DURATION = D ≤ $\frac{L_t}{3} = \frac{0.19}{3} =$ 0.06 HR < 5 MIN.

USE D = 5 MIN = 0.083 HR

10) TIME TO PEAK, $T_p = \frac{D}{2} + L_t = \frac{0.083}{2} + 0.19$

T_p = 0.23

11) PEAK DISCHARGE $q_p = \frac{484 \times A}{T_p} = \frac{484 \times 0.20}{0.23}$

q_p = 421 CFS

URSEL GINGERICH DAM (10393)

DETERMINATION OF PMP

1) DETERMINE AREA OF DRAINAGE BASIN

D.A. = 129 AC = 0.20 SQ. MI.

2) DETERMINE PMP INDEX RAINFALL (200 SQ. MI., 24 HR DURATION)

LOCATION OF CENTEROID OF BASIN

LONGITUDE = 92° 34' 25"

LATITUDE = 40° 32' 05"

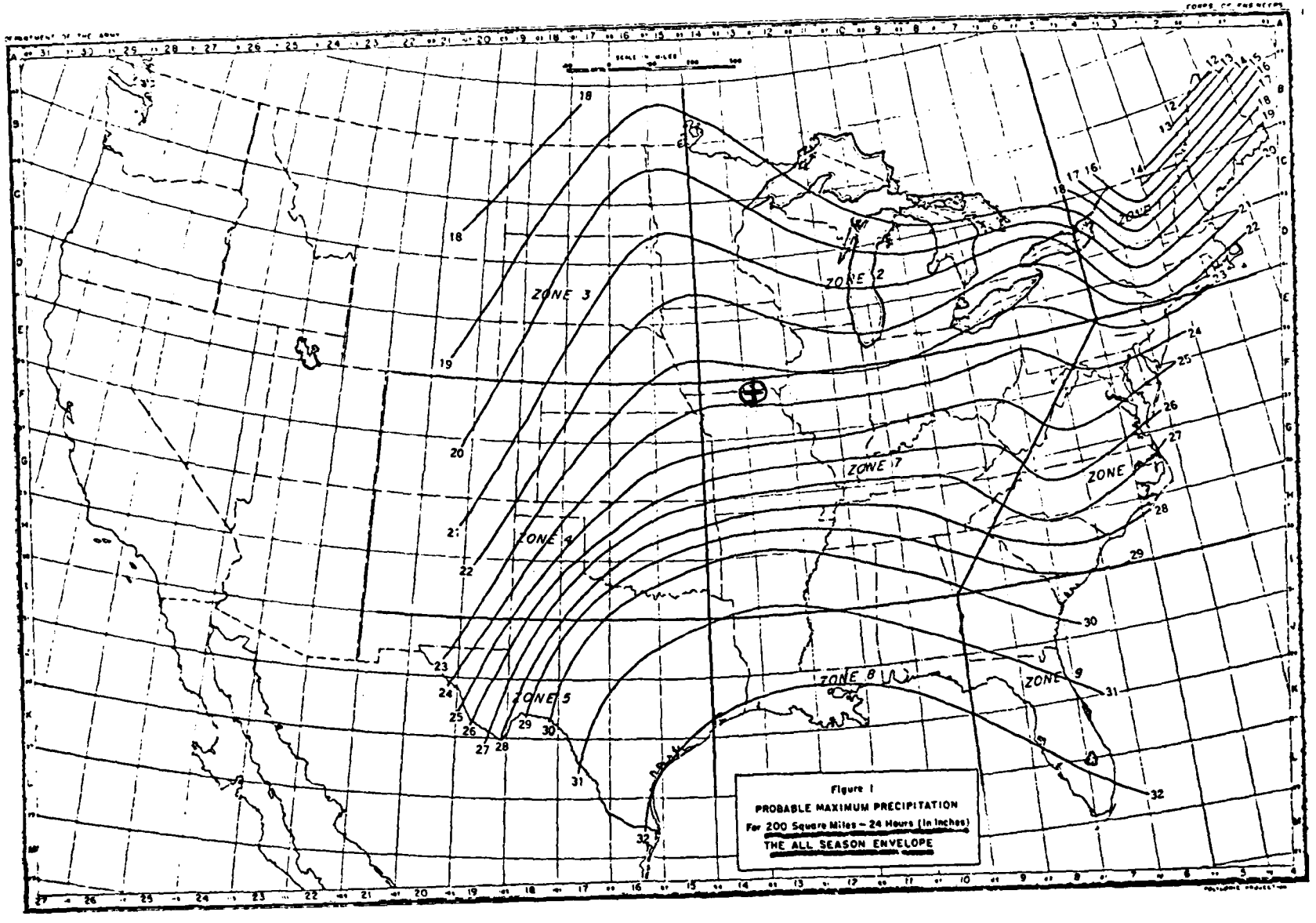
⇒ ZONE 7, PMP INDEX = 23.7

3) DETERMINE BASIN RAINFALL IN TERMS OF PERCENTAGE OF PMP INDEX RAINFALL FOR VARIOUS DURATIONS:

LOCATION: LONGITUDE 92° 34' 25"

LATITUDE 39° 47' 34"

DURATION (HR)	PERCENT OF INDEX RAINFALL %	TOTAL RAINFALL (IN)	RAINFALL INCREMENTS (IN)	DURATION OF INCREMENTS (HR)
6	100	23.7	23.7	6
12	120	28.4	4.7	6
24	130	30.8	2.4	12



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URSEL GINGRICH DAM
(No. 10393)

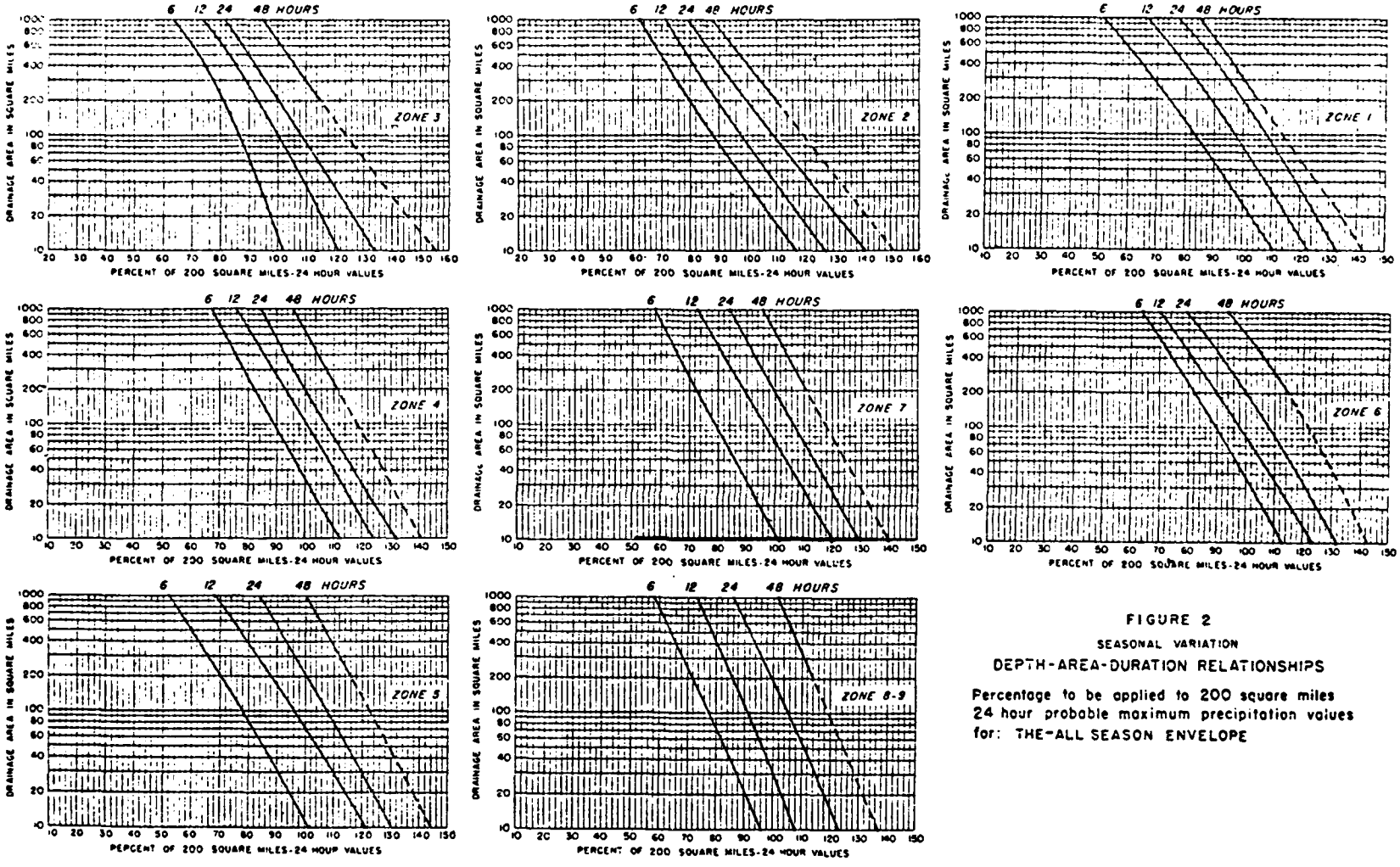

FIGURE 2

SEASONAL VARIATION

DEPTH-AREA-DURATION RELATIONSHIPS

Percentage to be applied to 200 square miles 24 hour probable maximum precipitation values for: THE-ALL SEASON ENVELOPE

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 1 OF

URSEL GINGERICH DAM (10393) JOB NO. 1240-001-

SOIL GROUP AND CURVE NUMBER DETERMINATION BY KLB DATE 8-2

URSEL GINGERICH DAM (10393)

HYDROLOGIC SOIL GROUP AND CURVE NUMBER

1. WATERSHED SOILS IN THIS BASIN CONSIST PRIMARILY OF GROUP D SOILS AND SOME GROUP C SOILS. ASSUME GROUP D FOR THE ENTIRE WATERSHED.

2. THIS WATERSHED IS MOSTLY PASTURE LAND

ASSUME THE HYDROLOGIC CONDITION OF THIS WATERSHED IS "FAIR."

THUS CN = 84, for Group D Soils WITH AMC II

⇒ CN = 93 for Group D Soils WITH AMC-III

MISSOURI DAM 10393

100 YEAR FLOOD BY REGRESSION EQUATION.

REGRESSION EQUATION FOR THE 100 YEAR FLOOD FOR MISSOURI

$$Q_{100} = 85.1\, A^{0.934\, A^{-0.02}}\, S^{0.576}$$

WHERE:

A = DRAINAGE AREA in Sq Mi

S = MAIN CHANNEL SLOPE ft/mi (AVG. SLOPE BETWEEN 0.1L AND 0.85L)

FOR MISSOURI DAM 10393

A = 0.20 Sq Mi

S = 55 ft/mi

$$Q_{100} = 85.1\, (0.2)^{0.934\, (0.2)^{-0.02}}\, (55)^{0.576}$$

$$= \underline{181 \text{ CFS}}$$

HEC1DB INPUT DATA

```
*************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  26 FEB 79
*************************************
A1                 DAM SAFETY INSPECTION - MISSOURI
A2                 URSEL GINGERICH DAM (MO.10393)
A3                   PMF AND 50 PERCENT PMF
B     300      0       5       0       0       0       0       0       0       0
B1      5
J       1      2       1
J1      1    .5
K       0  10393
K1  INPUT PRECIPITATION VALUES, RATIOS AND UNIT HYDROGRAPH PARAMETERS
M       1      2    0.20            0.20      1
P           23.7     100     120     130
T                                                          -1     -93
W2          .19
X       0      0       1
K       1  10393
K1  ROUTE HYDROGRAPH THROUGH URSEL GINGERICH DAM
Y                              1       1
Y1                                                      -967      -1
Y4    967  968.8  970.27  971.34  971.59  973.13  976.13  979.13
Y5      0     17     217     560    1012    4240   15538   30951
$S      0     48      96     303
$E    955    967   970.3     980
$$    967
$D  970.3
K      99
```

B-16

INFLOW PMF AND ONE-HALF PMF HYDROGRAPHS

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 10393
ROUTE HYDROGRAPH TO 10393
END OF NETWORK

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

RUN  DATE= 79/10/09.
     TIME= 13.51.49.
```

DAM SAFETY INSPECTION - MISSOURI
UPSEL GINGERICH DAM (NO.10393)
PMF AND 50 PERCENT PMF

JOB SPECIFICATION

NS	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1

RTIOS= 1.00 .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT PRECIPITATION VALUES, RATIOS AND UNIT HYDROGRAPH PARAMETERS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10393	0	0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.20	0.00	.20	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.70	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
3	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-93.00	0.00	0.00

CURVE NO = -93.00 WETNESS = -1.00 EFFECT CN = 93.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .19

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.30 RTIOR= 1.00

UNIT HYDROGRAPH 13 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .19 VOL= 1.00

109.	350.	413.	388.	163.	92.	51.	28.	16.	9.
5.	3.	1.							

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.35	151	.20	.20	.00	294.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	152	.20	.20	.00	298.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	153	.20	.20	.00	300.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	154	.20	.20	.00	302.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.5	155	.20	.20	.00	303.
1.01	.30	6	.01	0.00	.01	0.	1.01	13.00	156	.20	.20	.00	303.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	157	.24	.24	.00	307.
1.01	.40	8	.01	0.00	.01	0.	1.01	13.10	158	.24	.24	.00	321.
1.01	.45	9	.01	0.00	.01	0.	1.01	13.15	159	.24	.24	.00	326.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	160	.24	.24	.00	330.
1.01	.55	11	.01	0.00	.01	0.	1.01	13.25	161	.24	.24	.00	356.
1.01	1.00	12	.01	.00	.01	0.	1.01	13.30	162	.24	.24	.00	360.
1.01	1.05	13	.01	.00	.01	0.	1.01	13.35	163	.24	.24	.00	362.
1.01	1.10	14	.01	.00	.01	0.	1.01	13.40	164	.24	.24	.00	363.
1.01	1.15	15	.01	.00	.01	1.	1.01	13.45	165	.24	.24	.00	364.
1.01	1.20	16	.01	.00	.01	1.	1.01	13.50	166	.24	.24	.00	365.
1.01	1.25	17	.01	.00	.01	2.	1.01	13.55	167	.24	.24	.00	365.
1.01	1.30	18	.01	.00	.01	2.	1.01	14.00	168	.24	.24	.00	365.
1.01	1.35	19	.01	.00	.01	3.	1.01	14.05	169	.30	.30	.05	372.
1.01	1.40	20	.01	.00	.01	3.	1.01	14.10	170	.30	.30	.00	392.
1.01	1.45	21	.01	.00	.01	4.	1.01	14.15	171	.30	.30	.00	417.
1.01	1.50	22	.01	.00	.01	4.	1.01	14.20	172	.30	.30	.00	435.
1.01	1.55	23	.01	.00	.01	5.	1.01	14.25	173	.30	.30	.00	445.
1.01	2.00	24	.01	.00	.01	5.	1.01	14.30	174	.30	.30	.00	450.
1.01	2.05	25	.01	.00	.01	6.	1.01	14.35	175	.30	.30	.00	453.
1.01	2.10	26	.01	.00	.01	6.	1.01	14.40	176	.30	.30	.00	455.
1.01	2.15	27	.01	.00	.01	7.	1.01	14.45	177	.30	.30	.00	456.
1.01	2.20	28	.01	.01	.01	7.	1.01	14.50	178	.30	.30	.00	457.
1.01	2.25	29	.01	.01	.01	7.	1.01	14.55	179	.30	.30	.00	457.
1.01	2.30	30	.01	.01	.01	8.	1.01	15.00	180	.30	.30	.00	457.
1.01	2.35	31	.01	.01	.01	8.	1.01	15.05	181	.18	.18	.00	449.
1.01	2.40	32	.01	.01	.01	8.	1.01	15.10	182	.36	.36	.00	434.
1.01	2.45	33	.01	.01	.01	9.	1.01	15.15	183	.36	.36	.00	439.
1.01	2.50	34	.01	.01	.01	9.	1.01	15.20	184	.54	.54	.00	497.
1.01	2.55	35	.01	.01	.01	9.	1.01	15.25	185	.63	.63	.00	606.
1.01	3.00	36	.01	.01	.01	10.	1.01	15.30	186	1.83	1.83	.00	828.
1.01	3.05	37	.01	.01	.01	10.	1.01	15.35	187	2.52	2.52	.00	1354.
1.01	3.10	38	.01	.01	.01	10.	1.01	15.40	188	.99	.99	.00	1967.
1.01	3.15	39	.01	.01	.01	10.	1.01	15.45	189	.63	.63	.00	2113.
1.01	3.20	40	.01	.01	.01	11.	1.01	15.50	190	.54	.54	.00	1818.
1.01	3.25	41	.01	.01	.01	11.	1.01	15.55	191	.36	.36	.00	1402.
1.01	3.30	42	.01	.01	.01	11.	1.01	16.00	192	.36	.36	.00	1086.
1.01	3.35	43	.01	.01	.01	11.	1.01	16.05	193	.28	.28	.00	855.
1.01	3.40	44	.01	.01	.01	11.	1.01	16.10	194	.28	.28	.00	688.
1.01	3.45	45	.01	.01	.01	12.	1.01	16.15	195	.28	.28	.00	579.
1.01	3.50	46	.01	.01	.01	12.	1.01	16.20	196	.28	.28	.00	511.
1.01	3.55	47	.01	.01	.01	12.	1.01	16.25	197	.28	.28	.00	474.
1.01	4.00	48	.01	.01	.00	12.	1.01	16.30	198	.28	.28	.00	453.
1.01	4.05	49	.01	.01	.00	12.	1.01	16.35	199	.28	.28	.00	441.
1.01	4.10	50	.01	.01	.00	13.	1.01	16.40	200	.28	.28	.00	433.
1.01	4.15	51	.01	.01	.00	13.	1.01	16.45	201	.28	.28	.00	430.
1.01	4.20	52	.01	.01	.00	13.	1.01	16.50	202	.28	.28	.00	429.
1.01	4.25	53	.01	.01	.00	13.	1.01	16.55	203	.28	.28	.00	428.
1.01	4.30	54	.01	.01	.00	13.	1.01	17.00	204	.28	.28	.00	428.
1.01	4.35	55	.01	.01	.00	13.	1.01	17.05	205	.22	.22	.00	421.
1.01	4.40	56	.01	.01	.00	14.	1.01	17.10	206	.22	.22	.00	401.

1.01	4.45	57	.01	.01	.00	14.	1.01	17.15	207	.22	.22	.00	376.
1.01	4.50	58	.01	.01	.00	14.	1.01	17.20	208	.22	.22	.00	368.
1.01	4.55	59	.01	.01	.00	14.	1.01	17.25	209	.22	.22	.00	360.
1.01	5.00	60	.01	.01	.00	14.	1.01	17.30	210	.22	.22	.00	353.
1.01	5.05	61	.01	.01	.00	14.	1.01	17.35	211	.22	.22	.00	345.
1.01	5.10	62	.01	.01	.00	14.	1.01	17.40	212	.22	.22	.00	338.
1.01	5.15	63	.01	.01	.00	14.	1.01	17.45	213	.22	.22	.00	331.
1.01	5.20	64	.01	.01	.00	15.	1.01	17.50	214	.22	.22	.00	337.
1.01	5.25	65	.01	.01	.00	15.	1.01	17.55	215	.22	.22	.00	336.
1.01	5.30	66	.01	.01	.00	15.	1.01	18.00	216	.22	.22	.00	336.
1.01	5.35	67	.01	.01	.00	15.	1.01	18.05	217	.02	.02	.00	315.
1.01	5.40	68	.01	.01	.00	15.	1.01	18.10	218	.02	.02	.00	246.
1.01	5.45	69	.01	.01	.00	15.	1.01	18.15	219	.02	.02	.00	164.
1.01	5.50	70	.01	.01	.00	15.	1.01	18.20	220	.02	.02	.00	103.
1.01	5.55	71	.01	.01	.00	15.	1.01	18.25	221	.02	.02	.00	71.
1.01	6.00	72	.01	.01	.00	15.	1.01	18.30	222	.02	.02	.00	56.
1.01	6.05	73	.07	.05	.01	20.	1.01	18.35	223	.02	.02	.00	43.
1.01	6.10	74	.07	.05	.01	34.	1.01	18.40	224	.02	.02	.00	37.
1.01	6.15	75	.07	.05	.01	52.	1.01	18.45	225	.02	.02	.00	34.
1.01	6.20	76	.07	.05	.01	65.	1.01	18.50	226	.02	.02	.00	32.
1.01	6.25	77	.07	.05	.01	73.	1.01	18.55	227	.02	.02	.00	31.
1.01	6.30	78	.07	.06	.01	76.	1.01	19.00	228	.02	.02	.00	31.
1.01	6.35	79	.07	.06	.01	82.	1.01	19.05	229	.02	.02	.00	31.
1.01	6.40	80	.07	.06	.01	84.	1.01	19.10	230	.02	.02	.00	31.
1.01	6.45	81	.07	.06	.01	86.	1.01	19.15	231	.02	.02	.00	31.
1.01	6.50	82	.07	.06	.01	87.	1.01	19.20	232	.02	.02	.00	31.
1.01	6.55	83	.07	.06	.01	88.	1.01	19.25	233	.02	.02	.00	31.
1.01	7.00	84	.07	.06	.01	89.	1.01	19.30	234	.02	.02	.00	31.
1.01	7.05	85	.07	.06	.01	90.	1.01	19.35	235	.02	.02	.00	31.
1.01	7.10	86	.07	.06	.01	91.	1.01	19.40	236	.02	.02	.00	31.
1.01	7.15	87	.07	.06	.01	91.	1.01	19.45	237	.02	.02	.00	31.
1.01	7.20	88	.07	.06	.01	92.	1.01	19.50	238	.02	.02	.00	31.
1.01	7.25	89	.07	.06	.01	92.	1.01	19.55	239	.02	.02	.00	31.
1.01	7.30	90	.07	.06	.01	93.	1.01	20.00	240	.02	.02	.00	31.
1.01	7.35	91	.07	.06	.00	93.	1.01	20.05	241	.02	.02	.00	31.
1.01	7.40	92	.07	.06	.00	94.	1.01	20.10	242	.02	.02	.00	31.
1.01	7.45	93	.07	.06	.00	94.	1.01	20.15	243	.02	.02	.00	31.
1.01	7.50	94	.07	.06	.00	94.	1.01	20.20	244	.02	.02	.00	31.
1.01	7.55	95	.07	.06	.00	95.	1.01	20.25	245	.02	.02	.00	31.
1.01	8.00	96	.07	.06	.00	95.	1.01	20.30	246	.02	.02	.00	31.
1.01	8.05	97	.07	.06	.00	95.	1.01	20.35	247	.02	.02	.00	31.
1.01	8.10	98	.07	.06	.00	96.	1.01	20.40	248	.02	.02	.00	31.
1.01	8.15	99	.07	.06	.00	96.	1.01	20.45	249	.02	.02	.00	31.
1.01	8.20	100	.07	.06	.00	96.	1.01	20.50	250	.02	.02	.00	31.
1.01	8.25	101	.07	.06	.00	96.	1.01	20.55	251	.02	.02	.00	31.
1.01	8.30	102	.07	.06	.00	97.	1.01	21.00	252	.02	.02	.00	31.
1.01	8.35	103	.07	.06	.00	97.	1.01	21.05	253	.02	.02	.00	31.
1.01	8.40	104	.07	.06	.00	97.	1.01	21.10	254	.02	.02	.00	31.
1.01	8.45	105	.07	.06	.00	97.	1.01	21.15	255	.02	.02	.00	31.
1.01	8.50	106	.07	.06	.00	97.	1.01	21.20	256	.02	.02	.00	31.
1.01	8.55	107	.07	.06	.00	98.	1.01	21.25	257	.02	.02	.00	31.
1.01	9.00	108	.07	.06	.00	98.	1.01	21.30	258	.02	.02	.00	31.
1.01	9.05	109	.07	.06	.00	98.	1.01	21.35	259	.02	.02	.00	31.
1.01	9.10	110	.07	.06	.00	98.	1.01	21.40	260	.02	.02	.00	31.
1.01	9.15	111	.07	.06	.00	98.	1.01	21.45	261	.02	.02	.00	31.
1.01	9.20	112	.07	.06	.00	98.	1.01	21.50	262	.02	.02	.00	31.
1.01	9.25	113	.07	.06	.00	98.	1.01	21.55	263	.02	.02	.00	31.
1.01	9.30	114	.07	.06	.00	98.	1.01	22.00	264	.02	.02	.00	31.
1.01	9.35	115	.07	.06	.00	99.	1.01	22.05	265	.02	.02	.00	31.
1.01	9.40	116	.07	.06	.00	99.	1.01	22.10	266	.02	.02	.00	31.

1.01	9.45	117	.07	.06	.00	99.	1.01	22.15	267	.02	.02	.00	31.
1.01	9.50	118	.07	.06	.00	99.	1.01	22.20	268	.02	.02	.00	31.
1.01	9.55	119	.07	.06	.00	99.	1.01	22.25	269	.02	.02	.00	31.
1.01	10.00	120	.07	.06	.00	99.	1.01	22.30	270	.02	.02	.00	31.
1.01	10.05	121	.07	.06	.00	99.	1.01	22.35	271	.02	.02	.00	31.
1.01	10.10	122	.07	.06	.00	99.	1.01	22.40	272	.02	.02	.00	31.
1.01	10.15	123	.07	.06	.00	99.	1.01	22.45	273	.02	.02	.00	31.
1.01	10.20	124	.07	.06	.00	99.	1.01	22.50	274	.02	.02	.00	31.
1.01	10.25	125	.07	.06	.00	99.	1.01	22.55	275	.02	.02	.00	31.
1.01	10.30	126	.07	.06	.00	100.	1.01	23.00	276	.02	.02	.00	31.
1.01	10.35	127	.07	.06	.00	100.	1.01	23.05	277	.02	.02	.00	31.
1.01	10.40	128	.07	.06	.00	100.	1.01	23.10	278	.02	.02	.00	31.
1.01	10.45	129	.07	.06	.00	100.	1.01	23.15	279	.02	.02	.00	31.
1.01	10.50	130	.07	.06	.00	100.	1.01	23.20	280	.02	.02	.00	31.
1.01	10.55	131	.07	.06	.00	100.	1.01	23.25	281	.02	.02	.00	31.
1.01	11.00	132	.07	.06	.00	100.	1.01	23.30	282	.02	.02	.00	31.
1.01	11.05	133	.07	.06	.00	100.	1.01	23.35	283	.02	.02	.00	31.
1.01	11.10	134	.07	.06	.00	100.	1.01	23.40	284	.02	.02	.00	31.
1.01	11.15	135	.07	.06	.00	100.	1.01	23.45	285	.02	.02	.00	31.
1.01	11.20	136	.07	.06	.00	100.	1.01	23.50	286	.02	.02	.00	31.
1.01	11.25	137	.07	.06	.00	100.	1.01	23.55	287	.02	.02	.00	31.
1.01	11.30	138	.07	.06	.00	100.	1.02	0.00	288	.02	.02	.00	31.
1.01	11.35	139	.07	.06	.00	100.	1.02	.05	289	0.00	0.00	0.00	29.
1.01	11.40	140	.07	.06	.00	100.	1.02	.10	290	0.00	0.00	0.00	22.
1.01	11.45	141	.07	.06	.00	100.	1.02	.15	291	0.00	0.00	0.00	13.
1.01	11.50	142	.07	.06	.00	100.	1.02	.20	292	0.00	0.00	0.00	7.
1.01	11.55	143	.07	.06	.00	100.	1.02	.25	293	0.00	0.00	0.00	4.
1.01	12.00	144	.07	.06	.00	100.	1.02	.30	294	0.00	0.00	0.00	2.
1.01	12.05	145	.20	.19	.00	115.	1.02	.35	295	0.00	0.00	0.00	1.
1.01	12.10	146	.20	.19	.00	160.	1.02	.40	296	0.00	0.00	0.00	1.
1.01	12.15	147	.20	.20	.00	214.	1.02	.45	297	0.00	0.00	0.00	0.
1.01	12.20	148	.20	.20	.00	254.	1.02	.50	298	0.00	0.00	0.00	0.
1.01	12.25	149	.20	.20	.00	275.	1.02	.55	299	0.00	0.00	0.00	0.
1.01	12.30	150	.20	.20	.00	287.	1.02	1.00	300	0.00	0.00	0.00	0.
									SUM	30.41	29.92	.89	46346.
										(772.)(760.)(22.)(1312.)			

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2113.	503.	161.	134.	46324.
CMS	59.	14.	5.	4.	1312.
INCHES		23.40	29.92	29.92	29.92
MM		594.40	760.09	760.09	760.09
AC-FT		249.	319.	319.	319.
THOUS CU M		308.	394.	394.	394.

HYDROGRAPH AT STA 10393 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	2.	2.	3.	3.
4.	4.	5.	5.	6.	6.	7.	7.	8.	8.
8.	8.	9.	9.	9.	10.	10.	10.	10.	11.
11.	11.	11.	11.	12.	12.	12.	12.	12.	13.
13.	13.	13.	13.	13.	14.	14.	14.	14.	14.
14.	14.	14.	15.	15.	15.	15.	15.	15.	15.
16.	15.	20.	34.	52.	65.	73.	78.	82.	84.
86.	87.	88.	89.	90.	91.	91.	92.	92.	93.
93.	94.	94.	94.	95.	95.	95.	96.	96.	96.
96.	97.	97.	97.	97.	97.	98.	98.	98.	98.

98.	98.	98.	98.	99.	99.	99.	99.	99.	99.
99.	99.	99.	99.	99.	100.	100.	100.	100.	100.
100.	100.	100.	100.	100.	100.	100.	100.	100.	100.
100.	100.	100.	100.	118.	160.	214.	254.	275.	287.
294.	298.	300.	302.	302.	303.	307.	321.	338.	350.
356.	360.	362.	363.	364.	355.	365.	365.	372.	392.
417.	435.	445.	430.	453.	455.	456.	457.	457.	457.
445.	424.	439.	497.	606.	828.	1354.	1757.	2113.	1818.
1402.	1986.	855.	688.	579.	911.	474.	453.	441.	633.
450.	429.	428.	428.	421.	401.	376.	358.	348.	343.
340.	338.	337.	337.	335.	336.	315.	246.	144.	103.
71.	53.	43.	37.	34.	32.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	24.	22.
13.	7.	4.	2.	1.	1.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2113.	503.	151.	154.	46324.
CMS	60.	14.	5.	4.	1312.
INCHES		23.40	29.92	29.92	29.92
MM		594.40	760.09	760.09	760.09
AC-FT		249.	319.	319.	319.
THOUS CU M		308.	394.	394.	394.

HYDROGRAPH AT STA 10333 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	1.	1.	2.
2.	2.	2.	3.	3.	3.	3.	4.	4.	4.
4.	4.	4.	5.	5.	5.	5.	5.	5.	5.
5.	6.	6.	6.	5.	6.	6.	6.	6.	6.
6.	6.	7.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	7.	8.	8.
8.	8.	10.	17.	26.	33.	37.	39.	41.	42.
43.	43.	44.	45.	45.	45.	46.	46.	46.	46.
47.	47.	47.	47.	47.	48.	48.	48.	48.	48.
48.	48.	48.	49.	49.	49.	49.	49.	49.	49.
49.	49.	49.	49.	49.	49.	49.	49.	49.	50.
50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	57.	80.	107.	127.	138.	144.
147.	149.	150.	151.	151.	151.	154.	161.	169.	175.
178.	180.	181.	182.	182.	182.	182.	183.	186.	196.
208.	217.	222.	225.	227.	228.	228.	228.	228.	229.
222.	212.	219.	248.	303.	414.	677.	984.	1057.	909.
701.	543.	428.	344.	289.	256.	237.	227.	220.	217.
215.	214.	214.	214.	211.	200.	188.	179.	174.	171.
170.	169.	169.	168.	158.	158.	157.	123.	82.	52.
36.	26.	21.	19.	17.	16.	16.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	13.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	14.	11.

7.	4.	2.	1.	1.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1057.	252.	80.	77.	23162.
CMS	30.	7.	2.	2.	656.
INCHES		11.72	14.96	14.96	14.96
MM		297.20	380.04	380.04	380.04
AC-FT		125.	160.	160.	160.
THOUS CU M		154.	197.	197.	197.

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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH URSEL GINGERICH DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10393	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
0	0	0	0.000	0.000	0.000	-967.	-1

STAGE	967.00	968.80	970.27	971.74	971.69	975.13	976.13	979.13
FLOW	0.00	17.00	217.00	560.00	1312.00	4240.00	15558.00	30851.00
CAPACITY=	0.	48.	96.	384.				
ELEVATION=	955.	967.	970.	980.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
967.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
970.3	0.0	0.0	0.

STATION 10393, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	1.	1.	1.	1.	1.
	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
	1.	1.	1.	1.	1.	2.	2.	2.	2.	2.
	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
	3.	3.	3.	3.	3.	3.	4.	4.	4.	4.
	5.	5.	6.	6.	7.	7.	7.	8.	8.	8.
	9.	9.	10.	10.	10.	11.	11.	11.	12.	12.
	12.	13.	13.	14.	14.	14.	15.	15.	16.	

B-24

SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .50
HYDROGRAPH AT	10393	.20	1	2113.	1057.
	(	.52)	(	59.85)(	29.92)(
ROUTED TO	10393	.20	1	1680.	47[illegible].
	(	.52)	(	47.58)(	13.44)(

B-26

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	967.00	967.00	970.30
STORAGE	48.	48.	96.
OUTFLOW	0.	0.	227.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	971.90	1.69	132.	1680.	5.33	15.83	0.00
.50	971.07	.77	113.	475.	2.17	16.08	0.00

B-27

PERCENT OF PMF FLOOD ROUTING
EQUAL TO SPILLWAY CAPACITY

PREVIEW OF SEQUENCE OF STRLAN NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	10393
ROUTE HYDROGRAPH TO	10393
END OF NETWORK	

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

 RUN  DATE= 79/10/09.
      TIME= 13.43.07.
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DAM SAFETY INSPECTION - MISSOURI
URSEL GINGERICH DAM (MO.10393)
PERCENT PMF

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
309	0	5	3	0	0	0	0	4	0

JOPER	HWT	LPRNT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 7 LRTIO= 1

RTIOS= .24 .25 .26 .27 .28 .29 .30

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SUB-AREA RUNOFF COMPUTATION

INPUT PRECIPITATION VALUES, RATIOS AND UNIT HYDROGRAPH PARAMETERS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10393	0	0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.20	0.00	.20	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.70	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-93.00	0.00	0.00

CURVE NO = -93.00 WETNESS = -1.00 EFFECT CN = -93.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .19

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 30.41 29.92 .99 66348.
(765.11(760.11 22618 1512.379

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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH JESEL GINGERICH DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10393	1	0	0	3	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
0	0	0	0.000	0.000	0.000	-967.	-1

STAGE	967.00	968.60	97..27	971.54	971.69	977.13	979.15	979.13
FLOW	0.00	17.00	217.00	567.00	1112.00	4249.00	15539.00	30951.00
CAPACITY=	0.	45.	96.	303.				
ELEVATION=	955.	967.	97..0	980.				

CHEL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
967.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
979.5	0.0	0.0	0.

PEAK OUTFLOW IS 170. AT TIME 16.17 HOURS

PEAK OUTFLOW IS 180. AT TIME 16.17 HOURS

PEAK OUTFLOW IS 190. AT TIME 16.17 HOURS

PEAK OUTFLOW IS 200. AT TIME 16.17 HOURS

PEAK OUTFLOW IS 209. AT TIME 16.17 HOURS

PEAK OUTFLOW IS 220. AT TIME 16.17 HOURS

PEAK OUTFLOW IS 236. AT TIME 16.08 HOURS

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B-31

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

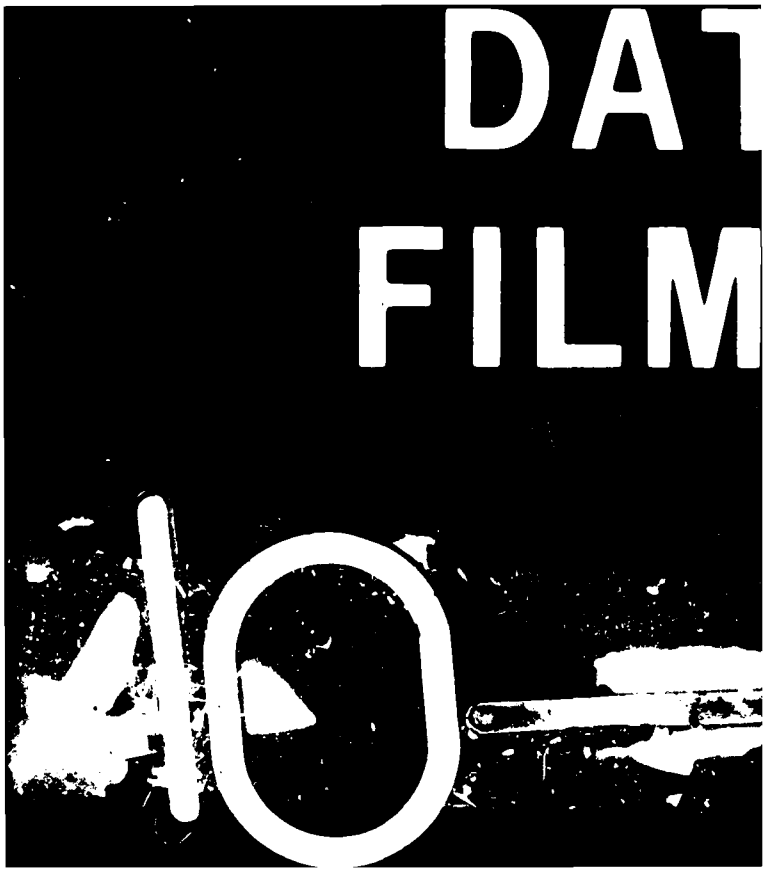
OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS						
				RATIO 1 .24	RATIO 2 .25	RATIO 3 .26	RATIO 4 .27	RATIO 5 .28	RATIO 6 .29	RATIO 7 .30
HYDROGRAPH AT	10393	.20	1	507.	528.	549.	571.	592.	613.	634.
		(.52)	(	14.36)(	14.96)(	15.56)(	16.18)(	16.78)(	17.36)(	17.95)(
ROUTED TO	10393	.20	1	170.	180.	190.	200.	209.	220.	236.
		(.52)	(	4.81)(	5.10)(	5.38)(	5.66)(	5.92)(	6.23)(	6.68)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	967.00	967.00	970.50
STORAGE	48.	48.	96.
OUTFLOW	0.	0.	227.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.24	969.92	0.00	91.	170.	0.00	16.17	0.00
.25	970.00	0.00	92.	180.	0.00	16.17	0.00
.26	970.07	0.00	93.	190.	0.00	16.17	0.00
.27	970.14	0.00	94.	200.	0.00	16.17	0.00
.28	970.21	0.00	95.	205.	0.00	16.17	0.00
.29	970.28	0.00	96.	220.	0.00	16.17	0.00
.30	970.33	.03	97.	236.	.33	16.08	0.00


DAT
FILM
40